2015 URBAN WATER MANAGEMENT PLAN

for the City and County of San Francisco

PUBLIC REVIEW DRAFT

Prepared by: The San Francisco Public Utilities Commission
April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

Note: Primary table numbers and titles are specific to the body of this 2015 UWMP. Secondary table numbers and titles that are shown in brackets and italicized (e.g., *[Standardized Table 3-1 Retail: Population – Current and Projected]* indicate the corresponding standardized table that is required to be submitted to DWR in a prescribed format. Standardized tables are provided in **Appendix B**, and SB X7-7 Verification Form tables are provided in **Appendix D**.

ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
ABAG	Association of Bay Area Governments
AF	acre-feet (volume of water, equivalent to 325,851 gallons)
Act	California Urban Water Management Planning Act
ACWD	Alameda County Water District
AMI	Area Median Income
AWWA	American Water Works Association
BACWA	Bay Area Clean Water Agencies
BAIRWMP	Bay Area Integrated Regional Water Management Plan
BARR	Bay Area Regional Reliability
BAWSCA	Bay Area Water Supply and Conservation Agency
BDPL	Bay Division Pipeline
BG	billion gallons
BMP	Best Management Practice
Castlewood CSA	Castlewood County Service Area
CCF	hundred cubic feet (volume of water, equivalent to 748 gallons)
CCWD	Contra Costa Water District
CEQA	California Environmental Quality Act
cfs	cubic feet per second (flow rate of water)
CII	commercial, industrial, and institutional
Cordilleras MWC	Cordilleras Mutual Water Company
City	City and County of San Francisco
CUWA	California Urban Water Agencies
CUWCC	California Urban Water Conservation Council
CWC	California Water Code
DMMs	demand management measures
DRIP	Tier 2 Drought Implementation Plan for Wholesale Customers
DSOD	Division of Safety of Dams
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
EIR	Environmental Impact Report
EOP	Emergency Operations Plan
ERRP	Emergency Response and Recovery Plan
FERC	Federal Energy Regulatory Commission
FY	fiscal year
GPCD	gallons per capita per day
gpm	gallons per minute
Groveland CSD	Groveland Community Services District
HET	High-efficiency toilet

HTWTP	Harry Tracy Water Treatment Plant
IRWM	Integrated Regional Water Management
ISA	Interim Supply Allocation
ISG	Individual Supply Guarantee
MG	million gallons
mgd	million gallons per day (flow or usage rate of water)
MID	Modesto Irrigation District
MOU	Memorandum of Understanding
NSMCSD	North San Mateo County Sanitation District, a subsidiary of the City of Daly City
PEIR	Programmatic Environmental Impact Report
RWS	Hetch Hetchy Regional Water System or Hetch Hetchy Regional Water System watersheds
RWSAP	Retail Water Shortage Allocation Plan
SB	Senate Bill
SB X7-7	Senate Bill Seven of the Senate's Seventh Extraordinary Session of 2009 (a.k.a., Water Conservation Act of 2009)
SCVWD	Santa Clara Valley Water District
SFDBI	San Francisco Department of Building Inspection
SFDPH	San Francisco Department of Public Health
SFPUC	San Francisco Public Utilities Commission
SFUSD	San Francisco Unified School District
SFO	San Francisco International Airport
State	State of California
SVWTP	Sunol Valley Water Treatment Plant
SWRCB	State Water Resources Control Board
SWRCB DDW	SWRCB Division of Drinking Water, formerly the California Department of Public Health Drinking Water Program
TID	Turlock Irrigation District
U.S.	United States
USEPA	U.S. Environmental Protection Agency
UV	ultraviolet
UWMP	Urban Water Management Plan
WPCP	water pollution control plant
WSA	2009 Water Supply Agreement between SFPUC and its Wholesale Customers
WSAP	Water Shortage Allocation Plan
WSIP	Water System Improvement Program
WUEdata	DWR Water Use Efficiency data online submittal tool
Zone 7	Zone 7 Water Agency

This page intentionally left blank.

SECTION 1: INTRODUCTION AND OVERVIEW

The San Francisco Public Utilities Commission (SFPUC) is pleased to present this 2015 update to the Urban Water Management Plan (UWMP) for the City and County of San Francisco (City).

The City owns and operates the Hetch Hetchy Regional Water System (RWS), a public asset that plays a key role in delivering high-quality drinking water to 2.6 million residents and businesses in the San Francisco Bay Area. The system collects water from the Tuolumne River in the Sierra Nevada and from protected local watersheds in the East Bay and Peninsula.

With the RWS, the SFPUC delivers water to 28 wholesale customers in Alameda, Santa Clara, and San Mateo Counties, including the Groveland Community Services District (Groveland CSD) in Tuolumne County. The Bay Area Water Supply and Conservation Agency (BAWSCA) represents the interests of 26 of the wholesale customers and also coordinates their water conservation programming. The SFPUC also provides retail water service to customers in San Francisco and a small number of customers outside of San Francisco that are located along the RWS transmission system. Additionally, some retail customers are supplied with local groundwater and recycled water supplies.

The State of California (State) is currently in the fourth year of a severe drought, one that is said to be the driest in the hydrologic record. The unprecedented dry weather conditions prompted Governor Jerry Brown to declare a drought State of Emergency in January 2014, which remains in effect. Subsequent Statewide conservation mandates spurred the SFPUC to request that all customers of the RWS voluntarily reduce water use by at least 10%. As the drought continued, the State Water Resources Control Board (SWRCB) issued rationing requirements to all water agencies in the State with the goal of achieving 25% statewide reductions in water use. The SFPUC and its customers have been required to reduce water use by 8 to 36% depending on pre-drought use. The SFPUC's customers are meeting this call and continue to be among the lowest water consumers in the State. In fact, consumption has reached a historic low. However, the SFPUC remains committed to comprehensive water efficiency efforts that will help sustain a continued reduction in water use.

The current drought underscores the need to continue developing local water supplies and water conservation programs, both in the wholesale and retail service areas. While local supplies often require a significant amount of time to plan and implement, the SFPUC is more committed than ever to developing a comprehensive water portfolio that balances future needs. Additionally, the SFPUC continues to work with other Bay Area water agencies to explore regional water supply opportunities such as transfers, desalination, and potable reuse that can be jointly developed.

This 2015 UWMP update presents the latest information on the SFPUC's retail and wholesale service areas, RWS and other water systems operated by the SFPUC, system supplies and demands, water supply reliability, Water Conservation Act of 2009 compliance, water shortage contingency planning, and demand management. In addition, this update includes the SFPUC's current (Fiscal Year 2014-15) and projected demands and supplies for its retail and wholesale customers over the next 25 years. Retail demand projections have been updated to reflect population and employment growth, socioeconomic factors, and the latest conservation forecasts. This 2015 UWMP update coincides with additional planning efforts conducted by the SFPUC, including its 2015 Retail Conservation Plan update.

This page intentionally left blank.

SECTION 2: PLAN PREPARATION AND IMPLEMENTATION

This section summarizes the actions taken by the San Francisco Public Utilities Commission (SFPUC) to assure agency coordination and public participation throughout the development of this 2015 Urban Water Management Plan (UWMP).

2.1 BASIS FOR PREPARING A PLAN

The SFPUC has prepared this 2015 UWMP for the City and County of San Francisco (City) in accordance with the requirements of the 1983 California Urban Water Management Planning Act (Act), California Water Code (CWC) Division 6, Part 2.6, Sections 10610 through 10656, as last amended in 2015. A copy of the Act is provided in **Appendix A**. The purpose of the Act is to assure that water suppliers plan for long-term reliability, conservation, and efficient use of California's water supplies to meet existing and future demands. The Act requires that planning projections extend at least 20 years beyond the year of the UWMP, i.e., through 2035 for the 2015 UWMP cycle. The planning horizon for the SFPUC 2015 UWMP is 25 years, i.e., through 2040.

The Act requires all urban water suppliers to prepare an UWMP every five years. The 2015 UWMPs are due to the California Department of Water Resources (DWR) by July 1, 2016. As defined by CWC Section 10617, an urban water supplier is a supplier (either publicly or privately owned) that provides water for municipal purposes to more than 3,000 customers (either directly or indirectly) or that supplies more than 3,000 acre-feet (AF) of water annually. The SFPUC meets these criteria as both a retail and wholesale supplier of water.

The SFPUC has prepared this individual UWMP specifically for the City, and is not participating in the preparation of a regional UWMP.

2.2 FISCAL OR CALENDAR YEAR AND UNITS OF MEASURE

The data provided throughout this 2015 UWMP and the accompanying standardized tables are reported on a fiscal year (FY) basis. The SFPUC operates on a fiscal year from July 1 through June 30. The "current" fiscal year reported in this 2015 UWMP corresponds to FY 2014-2015, which represents the period from July 1, 2014 through June 30, 2015. Similarly, the projected year of 2020 denotes FY 2019-2020, 2025 denotes FY 2024-2025, and so on. Best efforts are made to convert data that are originally collected on a calendar year basis to a fiscal year basis. However, in a few cases, fiscal year quantities are approximated based on calendar year quantities and are noted as such.

The SFPUC's water supply planning, contracts, and related documents primarily use units of million gallons per day (mgd) when quantifying volumes of water. However, the standardized tables prescribed by DWR only allow volumetric water data to be reported in units of acre-feet (AF), million gallons (MG), or hundred cubic feet (CCF) per year. Therefore, volumetric water data are reported in units of acre-feet (AF) rounded to the nearest 10 AF in the standardized tables (see **Appendix B**). The corresponding data in the body of this 2015 UWMP are reported in units of mgd unless otherwise noted. Although reported in different units of measure, the quantities between both sets of tables are equal. This approach has been discussed with and accepted by DWR staff.

2.3 COORDINATION AND OUTREACH

2.3.1 Agency Coordination

2.3.1.1 Coordination with City Agencies

The SFPUC coordinated with City agencies in developing elements of this 2015 UWMP and the documents referenced herein. The SFPUC consulted with the San Francisco Planning Department in developing water demand projections based on the City's growth projections. City agencies were notified of the SFPUC's intent to review the 2010 UWMP and prepare the 2015 UWMP update. The notice included instructions for viewing the draft 2015 UWMP, as well as the date, time, and location of the public hearing on the draft 2015 UWMP. Comments received from these agencies on the proposed 2015 UWMP were reviewed and addressed, as appropriate. Documentation relating to these efforts and communications will be provided in **Appendix C**.

2.3.1.2 Regional Interagency Coordination

The SFPUC coordinated on the development of this 2015 UWMP with its wholesale customers in addition to BAWSCA, which is a public agency representing 26 member agencies—24 cities and water districts, as well as two private utilities—in Alameda, Santa Clara, and San Mateo counties that purchase water on a wholesale basis from the RWS. The SFPUC has individual wholesale contracts with 27 agencies, 26 of which are members of BAWSCA. Cordilleras Mutual Water Company (Cordilleras MWC) is also a wholesale customer but not a member of BAWSCA. Groveland Community Services District (Groveland CSD) is considered a retail customer by the SFPUC, but for the purposes of this 2015 UWMP, is recognized as a wholesale customer. Throughout this document, references to Wholesale Customers generally mean the 26 wholesale customers that are members of BAWSCA. For more information about the SFPUC's wholesale customers, see **Section 3.3**.

The SFPUC provided water supply reliability information for distribution to all BAWSCA members. Supplies were projected in five-year increments from 2015 through 2040 for normal, single dry, and multiple dry years. These projections are provided in **Appendix C.** The SFPUC also worked with all of its wholesale customers, either individually or through BAWSCA, to obtain population and purchase projections in five-year increments through the year 2040. Wholesale customers that are urban water suppliers are concurrently preparing their own 2015 UWMP updates; therefore, the data provided for use in the SFPUC's 2015 UWMP are draft and subject to change.

Special coordination was also conducted with North Coast County Water District and the City of Daly City, two Wholesale Customers that also supply recycled water to SFPUC retail customers.

In addition to coordinating with its wholesale customers, the SFPUC also communicated with other Bay Area water agencies, including the East Bay Municipal Utility District (EBMUD), Santa Clara Valley Water District (SCVWD), Contra Costa Water District (CCWD), and Zone 7 Water Agency (Zone 7); and counties in which the SFPUC provides water, which are the counties of San Francisco, San Mateo, Alameda, Santa Clara, San Joaquin, and Tuolumne.

All wholesale customers, Bay Area water agencies, and counties in which SFPUC provides water were notified of the SFPUC's intent to review the 2010 UWMP and prepare the 2015 UWMP update. The notice included instructions for viewing the draft 2015 UWMP, as well as the date, time, and location of the public hearing on the draft 2015 UWMP. Comments received from these agencies on the proposed 2015 UWMP were reviewed and addressed, as appropriate. Documentation relating to these efforts and communications will be provided in **Appendix C**.

2.3.2 Public Participation

The SFPUC has always actively encouraged public participation in its urban water management planning efforts. Public outreach activities for the 2015 UWMP update are listed below. Further documentation is included in **Appendix C**.

Notification of the 2015 UWMP update was electronically mailed on January 29, 2016, with an additional mailing on March 8, 2016, to all cities and counties within which the SFPUC provides water, as well as to other interested parties. The notification letter served as both (1) a notice to cities and counties about the 2015 UWMP update, and (2) a notice of the time and place of the corresponding public hearing, as required by the CWC. A list of notified organizations and individuals is provided in **Appendix C**.

The SFPUC met with two stakeholder groups, the Citizens Advisory Committee and Bay Area Water Stewards, to present on the 2015 UWMP update. The Citizens Advisory Committee meeting held on March 22, 2016, which was publicly noticed on the SFPUC website at www.sfwater.org, took place before the draft 2015 UWMP was made available for public comment. However, committee members were encouraged to participate in the public review process when the draft became available for review. Comments on the draft 2015 UWMP will also be taken during the Bay Area Water Stewards meeting scheduled for May 5, 2016.

The draft 2015 UWMP was made available for review prior to the public hearing at the San Francisco Main Public Library and the main offices of the SFPUC. An electronic copy was also posted at www.sfwater.org.

A public hearing will be held on May 10, 2016 during an SFPUC Commission meeting. A notice of the hearing will be advertised in the local newspaper on April 25, 2016 and May 2, 2016 in accordance with California Government Code 6066. Additional noticing will be printed in local community newspapers in multiple languages to reach a more diverse local population. Copies of newspaper advertisements of the public hearing will be provided in **Appendix C**. Public comments on the draft 2015 UWMP will be taken during the public hearing, as well as for an approximately one month period prior to the public hearing.

An adoption hearing will be held on a subsequent SFPUC Commission meeting prior to the July 1, 2016 deadline for submittal to DWR.

For 2015 UWMP adoption, submittal, and implementation, see **Section 10.1**.

2.4 ACCOUNTING FOR GROVELAND CSD

Groveland CSD serves approximately 3,500 customers in Groveland, primarily of residential and commercial uses, located in a semi-rural area of southern Tuolumne County. Previous updates to the SFPUC's UWMP had reported Groveland CSD as a retail customer since Groveland CSD had not prepared its own UWMP until 2010. Furthermore, Groveland CSD is considered by the SFPUC to be a retail customer and is accounted as such in the SFPUC's contractual obligations and supply planning. However, for the purposes of the 2015 UWMP update, the SFPUC was directed by DWR to report Groveland CSD as a wholesale customer. In order to accommodate both the SFPUC's planning needs and DWR's requirements, this 2015 UWMP accounts for Groveland CSD differently depending on the context:

- For the purposes of describing the wholesale service area, population, demands, and supplies as directed by DWR, and to avoid potential double counting during regional or Statewide aggregation of UWMP data, Groveland CSD is considered a wholesale customer and reported as such in **Section 3** of the body of this UWMP and the standardized tables in **Appendix B**.

- For the purposes of describing contractual obligations and RWS supply allocations between the SFPUC and its Wholesale Customers, Groveland CSD is considered a retail customer and is reported as such in the body of this 2015 UWMP, specifically **Sections 4**, **6**, **7**, and **8**.

- For the purposes of calculating per capita baselines and targets in accordance with the Water Conservation Act of 2009, also known as Senate Bill (SB) X7-7, Groveland CSD is not considered a retail customer. Therefore, **Section 5** of the body of this 2015 UWMP and the corresponding SB X7-7 Verification Form tables in **Appendix D** do not include Groveland CSD.

The SFPUC obtained actual and projected population and demand data from Groveland CSD. As Groveland CSD is currently preparing its 2015 UWMP update, the data provided for use in the SFPUC's 2015 UWMP are draft and subject to change.

Any discrepancies between corresponding tables in the body of this 2015 UWMP and **Appendix B** resulting from the difference in Groveland CSD accounting will be noted. This approach has been discussed with and deemed appropriate by DWR staff.

SECTION 3: SYSTEM DESCRIPTION

This section describes the SFPUC's water system (including the RWS and in-City distribution system), retail and wholesale service areas, climate, and demographic features.

3.1 SFPUC WATER SYSTEM OVERVIEW

Over 2.6 million people in San Francisco and throughout the Bay Area rely on water supplied by the SFPUC to meet their daily water needs. The RWS is a municipally-owned utility operated by the SFPUC, a department of the City and County of San Francisco, and serves both retail and wholesale customers. The RWS supplies high-quality drinking water from the Tuolumne River watershed and from local reservoirs in the Alameda and Peninsula watersheds. The RWS draws an average of 85% of its supply from the Tuolumne River watershed, collected in Hetch Hetchy Reservoir in Yosemite National Park. This water feeds into an aqueduct system delivering water 167 miles by gravity to Bay Area reservoirs and customers. The remaining 15% of the RWS supply is drawn from local surface waters in the Alameda and Peninsula watersheds. The split between these resources varies from year to year depending on the water year hydrology and operational circumstances.

Separate from the RWS, the in-City distribution system is also owned and operated by the SFPUC and serves a population of nearly 850,000 in San Francisco. In-City retail customers are primarily served with RWS supply, but a few customers receive groundwater and recycled water. Similarly, suburban retail customers are primarily served with RWS supply, but a few customers receive groundwater. The RWS, in-City distribution system, and other localized systems are described in the following sections.

3.1.1 Historical Development of the RWS

The RWS evolved through the development of two separate water systems: the Spring Valley Water Company and the Hetch Hetchy Project. The Spring Valley Water Company was established in 1858 as it developed a spring and several creeks into a local water system. It expanded over the years with the construction of the Pilarcitos, San Andreas, and Upper and Lower Crystal Springs Dams on the Peninsula. Further expansions included the development of the Pleasanton Well Field, the Sunol Filter Gallery, and Calaveras Dam in southern Alameda County.

Very early in San Francisco's development, it was recognized that the local water resources would be inadequate to support a burgeoning metropolis; thus, plans for importing water from the Sierra Nevada were born. In the late 1800s, the City's decision to develop its own water supply system culminated in the planning, financing, and construction of the Hetch Hetchy Project. Because many of the Hetch Hetchy Project facilities were to be located on public land within Yosemite National Park and Stanislaus National Forest, Congressional approval of the use of federal land was required. That approval was granted by the Raker Act of 1913. For more information about the Raker Act and the City's water rights under State law, see **Section 6.1.2**.

The construction of the Hetch Hetchy Project began in earnest in 1914. After almost 20 years of construction (including building of Hetch Hetchy Reservoir and the 1930 acquisition of the Spring Valley Water Company by the City), Tuolumne River water began flowing into Upper Crystal Springs Reservoir in October 1934. Through the operation of the two systems, the SFPUC has been able to provide the residents of the City and its neighboring communities with a supply of high-quality potable water from protected sources.

Since the 1930s, the major additions to the RWS have included the raising of O'Shaughnessy Dam and the development of Lake Lloyd (a.k.a., Cherry Lake); the construction of additional pipelines across the San Joaquin Valley; and the local construction of San Antonio Reservoir in Alameda County and Bay Division Pipelines (BDPL)

Nos. 2, 3, and 4. Other local projects have included Crystal Springs Pipeline No. 3, Sunol Valley and San Andreas (now Harry Tracy) Filtration Plants, the Crystal Springs Bypass Tunnel and Balancing Reservoir, and the Tesla Treatment Facility.

3.1.2 Water Distribution

This section further describes how water is distributed by the RWS and the in-City distribution system.

3.1.2.1 Regional Water System

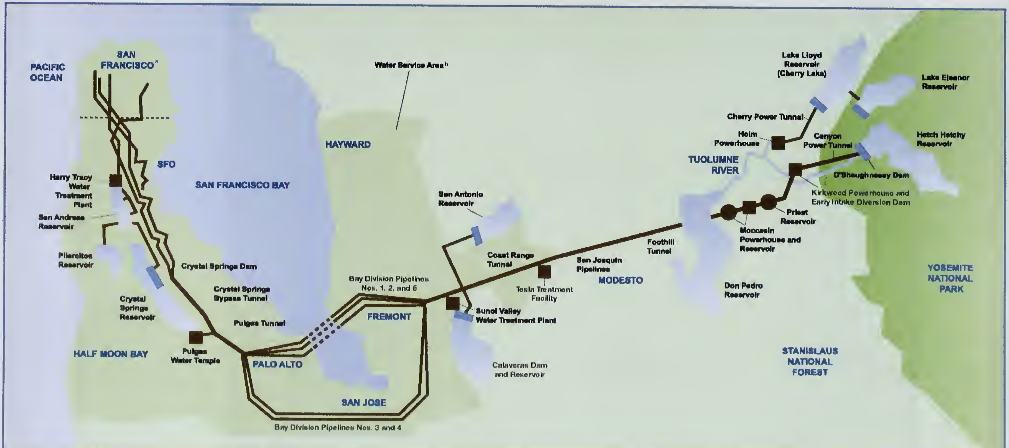
The RWS, shown in **Figure 3-1**, consists of more than 280 miles of pipeline and 60 miles of tunnels, 11 reservoirs, five pump stations, and two water treatment plants. It is geographically delineated between the Hetch Hetchy Project and the Bay Area water system facilities. The Hetch Hetchy Project is generally composed of the reservoirs, hydroelectric generation and transmission facilities, and water transmission facilities from the Hetch Hetchy Valley west to the Alameda East Portal of the Coast Range Tunnel in Sunol Valley. Water system components of the Hetch Hetchy Project are also referred to as the Hetch Hetchy System. The local Bay Area water system is comprised of two parts—the Alameda System and the Peninsula System—generally consisting of the facilities west of Alameda East Portal, including the 63,000-acre Alameda and Peninsula watersheds, storage reservoirs, two water treatment plants, and the distribution system that delivers water to retail and wholesale customers. The Hetch Hetchy, Alameda, and Peninsula Systems are described in more detail below.

- **Hetch Hetchy System:** In the Hetch Hetchy System, water is diverted from Hetch Hetchy Reservoir into a series of tunnels and aqueducts from the Sierra Nevada to the San Joaquin Pipelines that cross the San Joaquin Valley to the Coast Range Tunnel, which connects to the Alameda System at the Alameda East Portal. Hetch Hetchy System water is disinfected at the Tesla Treatment Facility.

- **Alameda System:** The Alameda System includes two reservoirs, San Antonio Reservoir and Calaveras Reservoir, which collect water from the San Antonio Creek, Upper Alameda Creek, and Arroyo Hondo watersheds in Alameda County. San Antonio Reservoir also receives water from the Hetch Hetchy System. Conveyance facilities in the Alameda System connect the Hetch Hetchy System and Alameda water sources to the Peninsula System. The BDPLs cross the South Bay to the Peninsula System delivering water to customers along the pipeline route. The Sunol Valley Water Treatment Plant (SVWTP) filters and disinfects water supplied from San Antonio Reservoir and Calaveras Reservoir.

- **Peninsula System:** The Peninsula System includes conveyance facilities connecting the BDPLs to the in-City distribution system and to other customers on the Peninsula. Two reservoirs, Crystal Springs Reservoir and San Andreas Reservoir, collect runoff from the San Mateo Creek watershed. Crystal Springs Reservoir also receives water from the Hetch Hetchy System. A third reservoir, Pilarcitos Reservoir, collects runoff from the Pilarcitos Creek watershed and directly serves one of the Wholesale Customers, the Coastside County Water District (which includes the City of Half Moon Bay), along with delivering water to Crystal Springs and San Andreas Reservoirs. The Harry Tracy Water Treatment Plant (HTWTP) filters and disinfects water supplied from Crystal Springs Reservoir and San Andreas Reservoir before it is delivered to customers on the Peninsula and the in-City distribution system.

Figure 3-1. Regional Water System



a Three pump stations on Treasure Island are not depicted

b The water service area shown is approximate and for illustrative purposes only. For more accurate boundaries of the retail and wholesale service areas, see Figures 3-[illegible] and 3-4, respectively

3.1.2.2 In-City Distribution System

San Francisco's in-City distribution system (Public Water System No. CA3810011) was originally developed during the 100-year period between 1860 and 1960, reflecting the patterns and rates of growth in the City. Several major pipelines convey RWS supply from the Peninsula System to the City. Water to the eastside of the in-City distribution system is fed by two pipelines that terminate at University Mound Reservoir. Water to the westside of the in-City distribution is fed by two pipelines that terminate at Sunset Reservoir and one that terminates at Merced Manor Reservoir. As shown in **Figure 3-2**, the in-City distribution system also includes 10 reservoirs and eight water tanks that store water supplied by the RWS. Seventeen pump stations [1] and approximately 1,250 miles of pipelines move water throughout the system and deliver water to homes and businesses in the City.

3.1.3 Water Treatment

The Hetch Hetchy Reservoir is the largest unfiltered water supply on the West Coast, and one of only a few large unfiltered municipal water supplies in the nation. The water originates from spring snow melt flowing down the Tuolumne River to Hetch Hetchy Reservoir, where it is stored. This high-quality water source comes from well-protected wilderness areas in Yosemite National Park and meets or exceeds all federal and State criteria for watershed protection. Water from Hetch Hetchy Reservoir is protected in pipes and tunnels as it is conveyed to the Bay Area, and requires pH adjustment to control pipeline corrosion and disinfection for bacteria control. Based on the SFPUC's disinfection treatment practice, extensive bacteriological quality monitoring, and high operational standards, the U.S. Environmental Protection Agency (USEPA) and the SWRCB Division of Drinking Water (DDW) determined that the Hetch Hetchy water source meets federal and State drinking water quality requirements without the need for filtration.

A new USEPA regulation took effect in 2012 requiring secondary disinfection for all unfiltered drinking water systems to control the waterborne parasite cryptosporidium. To comply with this regulation, the SFPUC completed construction of a new ultraviolet (UV) treatment facility in 2011. The Tesla Treatment Facility is a key component of the Water System Improvement Program (WSIP) and enhances the Hetch Hetchy System's high water quality. The facility has a capacity of 315 mgd, making it the third largest UV drinking water disinfection facility in the U.S.

All water derived from sources other than Hetch Hetchy Reservoir is treated at one of two treatment plants: the SVWTP or the HTWTP. The SVWTP primarily treats water from the Alameda System reservoirs and has both a peak capacity and sustainable capacity of 160 mgd. Treatment processes include coagulation, flocculation, sedimentation, filtration, and disinfection. Fluoridation, chloramination, and corrosion control treatment are provided for the combined Hetch Hetchy System and SVWTP water at the Sunol chloramination and fluoridation facilities. The HTWTP treats water from the Peninsula System reservoirs and has a peak capacity of 180 mgd and a sustainable capacity of 140 mgd. Treatment processes include ozonation, coagulation, flocculation, filtration, disinfection, fluoridation, corrosion control treatment, and chloramination. Major upgrades to the SVWTP were completed in 2013 and to the HTWTP in 2015.

[1] This number of pump stations does not include three pump stations on Treasure Island, which are not operated by the SFPUC.

Figure 3-2. In-City Distribution System

3.1.4 Water Storage

The majority of the water delivered by the SFPUC is supplied by runoff from the upper Tuolumne River watershed on the western slope of the central Sierra Nevada. Three major reservoirs collect runoff: Hetch Hetchy Reservoir, Lake Lloyd, and Lake Eleanor (**Table 3-1**). A "water bank" in Don Pedro Reservoir is integrated into system operations.[2] Don Pedro Reservoir is jointly owned and operated by Modesto Irrigation District and Turlock Irrigation District (the Districts), and is located on the Tuolumne River downstream of the Hetch Hetchy System.

As a by-product of water delivery and water supply management, hydroelectric power is generated by the Hetch Hetchy Water and Power System. Water stored in Hetch Hetchy Reservoir is used for hydroelectric generation and also satisfies instream flow requirements when released downstream. Normally, only Hetch Hetchy Reservoir water supplies are exported to the Bay Area, while releases from Lake Eleanor and Lake Lloyd are used to satisfy instream flow requirements, satisfy Raker Act entitlements to the Districts downstream, and produce hydroelectric power. The Hetch Hetchy Water and Power System is comprised of three major hydroelectric powerhouses along the Tuolumne River—Holm, Kirkwood, and Moccasin—that have a collective generating capacity of nearly 400 megawatts.

Downstream of the Hetchy Hetchy System, the SFPUC utilizes local watersheds in the Bay Area. On the Peninsula, the Crystal Springs, San Andreas, and Pilarcitos Reservoirs located in San Mateo County capture local watershed runoff. In the Alameda Creek watershed in Alameda County, the SFPUC operates Calaveras and San Antonio Reservoirs. In addition to using these facilities to capture local runoff, San Andreas, San Antonio, and Crystal Springs Reservoirs also provide storage for the Hetch Hetchy System and, along with Calaveras Reservoir, are an important water supply in the event of an interruption to Hetch Hetchy System deliveries.

Calaveras Reservoir is currently operating at one-third of its capacity due to restrictions imposed by the Division of Safety of Dams (DSOD). The Calaveras Dam Improvement Project is currently in construction to return the reservoir to its full capacity.

The in-City reservoirs and tanks have the capacity to hold approximately 413 MG of water. The SFPUC estimates this capacity to be a five-day supply at the current average water consumption rate for the City. In addition, there is an emergency supply of existing non-potable water immediately available within the City at Lake Merced. Lake Merced currently holds approximately 1.9 billion gallons of water. **Table 3-2** summarizes the storage capacity of in-City reservoirs and storage tanks, not including Lake Merced.

[2] Turlock and Modesto Irrigation Districts have senior water rights to the SFPUC for the Tuolumne River water and are entitled to the first increment of flow in the basin. Water bank provides a credit and debit system which allows the SFPUC to divert water upstream while meeting its obligations to Modesto and Turlock Irrigation Districts. Through this mechanism the SFPUC may pre-deliver the Districts entitlements and credit the water bank so that at other times the SFPUC may retain water upstream while the Districts debit water bank.

Table 3-1. Regional Water System Storage Capacity

[Standardized Table: Not Applicable]

RWS Reservoir	Storage	
	Acre-Feet (AF)	Billions of Gallons (BG)
Up-Country[a]		
Hetch Hetchy	360,360	117.4
Lake Lloyd[b]	273,300	89.1
Lake Eleanor	27,100	8.8
Subtotal Up-Country	**660,760**	**215.3**
Local		
Calaveras (East Bay)[c]	96,800	31.5
San Antonio (East Bay)	50,500	16.5
Crystal Springs (Peninsula)[d]	69,300	22.6
San Andreas (Peninsula)	19,000	6.2
Pilarcitos (Peninsula)	3,100	1.0
Subtotal Local	**238,700**	**77.8**
Total RWS Storage[e]	**899,460**	**293.1**

a Three other regulating reservoirs are also part of the RWS: Early Intake, Priest, and Moccasin Reservoirs.

b Storage capacity shown includes flashboards, which are structures placed in a spillway to increase the capacity of a reservoir.

c Calaveras Reservoir was constructed with a storage capacity of 96,800 AF. Since December 2001, in response to safety concerns about the seismic stability of the dam and a directive from the Division of Safety of Dams (DSOD), the SFPUC has held the maximum water level at approximately 37,800 AF (roughly 40% of its maximum capacity), pending construction of a new comparably sized replacement dam downstream, expected to be completed in 2018.

d Crystal Springs Reservoir has a maximum storage capacity of 22.1 BG (at 291.8 feet). When the Lower Crystal Springs Dam Improvement is complete, the reservoir will be operated normally at 287.8 feet (4 feet below capacity) based on permit conditions.

e This includes 63,700 AF in dead storage (i.e., the volume in a reservoir below the lowest controllable level). In addition, the SFPUC may draw against a credit of up to 570,000 AF in storage in a water bank account in Don Pedro Reservoir, for total storage for planning purposes of 1,469,460 AF.

Table 3-2. In-City Potable Water System Storage Capacity

[Standardized Table: Not Applicable]

In-City Reservoir	Storage	
	Acre-Feet (AF)	Millions of Gallons (MG)
Sunset	542	177
University Mound	432	141
Sutro	96	31
Summit	43	14
College Hill	41	13
Stanford Heights	40	13
Merced Manor	29	10
Lombard	8	3
Potrero	3	1
Hunters Point	3	1
Storage Tanks	29	9
Total In-City Storage	**1,267**[a]	**413**

a Rows above do not sum to total due to rounding.

3.1.5 Other Retail Water Systems

3.1.5.1 Groundwater and Recycled Water Systems

While the in-City distribution system is the primary system serving San Francisco customers, several customers receive either groundwater or recycled water. The San Francisco Recreation and Park Department operates and maintains groundwater wells serving irrigation and other non-potable uses (e.g., lake filling, water exhibits) at Golden Gate Park, the San Francisco Zoo, and landscaped medians along the Great Highway. More information about this groundwater supply is provided in **Section 6.2.1.1**.

The City's golf courses at Harding Park, which includes Fleming Golf Course and Sharp Park are provided recycled water for irrigation. Harding Park, an in-City retail customer, is served by the North San Mateo County Sanitation District (NSMCSD) in Daly City. Sharp Park, a suburban retail customer, is served by the North Coast County Water District (NCCWD) in Pacifica. Except for a portion of the Harding Park recycled water transmission line that is within City limits, and an onsite 700,000-gallon underground storage tank and above-ground pump station at Harding Park, the SFPUC neither owns nor operates either of these recycled water systems. More information about these recycled water supplies is provided in **Section 6.2.1.2**.

3.1.5.2 Suburban Retail Water Systems

The SFPUC serves numerous retail customers outside the City. These customers are collectively referred to as suburban retail customers or customers in the suburban retail service area. These customers are generally located right off of RWS transmission pipelines and do not form one contiguous service area. More information about the suburban retail service area is provided in **Section 3.2**. However, there are two small water systems in unincorporated Alameda County that are operated by the SFPUC as permitted by the SWRCB DDW (formerly the California Department of Public Health Drinking Water Program): the Castlewood Well System and the Town of Sunol domestic water system.

- **Castlewood Well System:** The SFPUC owns and operates the Pleasanton Well Field Water System (Public Water System No. CA0110018; herein referred to as the Castlewood Well System), which supplies about 0.4 mgd of treated (potable) groundwater to the Castlewood County Service Area (CSA), a community comprised of the Castlewood Country Club and approximately 190 homes located in unincorporated Alameda County. The Castlewood community water system itself is owned and operated by the CSA and the California Water Service Company, respectively.

  The SFPUC serves the Castlewood CSA through one metered connection with groundwater pumped from the Castlewood Well System. This system consists of four metered wells, a 3,000-gallon control tank, and a 1.0-million gallon treated water reservoir. The supply is disinfected via sodium hypochlorite injection into the transmission main between the control tank and reservoir. Water quality is monitored weekly by the SFPUC.

- **Town of Sunol Domestic Water System:** The SFPUC owns and operates the domestic water system for the Town of Sunol (Public Water System No. CA0110012), which typically serves less than 0.1 mgd to approximately 120 metered and unmetered connections in unincorporated Alameda County. These connections are primarily residential customers and are supplied with potable water from the RWS. After RWS supply is fully treated, fluoridated, and chloraminated, the supply enters Town of Sunol transmission pipeline downstream of Sunol Valley Mixing Manifold. The supply is then piped to a pump station at the SFPUC's Sunol Yard. The supply is pumped to two 130,000-gallon storage tanks. Water quality is overseen by the SFPUC.

In addition to serving customers in the Town of Sunol with RWS supply, the SFPUC also serves several customers in the larger Sunol area with supplies that are separate from the RWS. The Sunol Valley Golf Club is supplied with groundwater obtained via subsurface diversion from the Sunol Filter Gallery; however, the club was recently closed in January 2016, after the reporting period of this 2015 UWMP.

3.2 RETAIL SERVICE AREA

The SFPUC provides water to both retail and wholesale customers. A population of over 2.6 million people within the counties of San Francisco, San Mateo, Santa Clara, Alameda, San Joaquin, and Tuolumne rely entirely or in part on the water supplied by the SFPUC. Approximately two thirds of the SFPUC's water supply is delivered to wholesale customers, and the remaining one third is delivered to retail customers. This section describes the retail service area. For a description of the wholesale service area, see **Section 3.3**. Note that Groveland CSD is accounted for as a wholesale customer for the purpose of describing the wholesale service area, as explained in **Section 2.4**.

Retail customers include the residents, businesses, and industries located within City limits, referred to as the in-City retail service area. Retail service is also provided to a patchwork of customers located outside the City, such as the Town of Sunol, San Francisco International Airport (SFO), Lawrence Livermore National Laboratory, and Castlewood CSA. These areas are not contiguous and are collectively referred to as the suburban retail service area. Both the in-City and suburban retail service areas are shown in **Figure 3-3**.

3.2.1 Climate

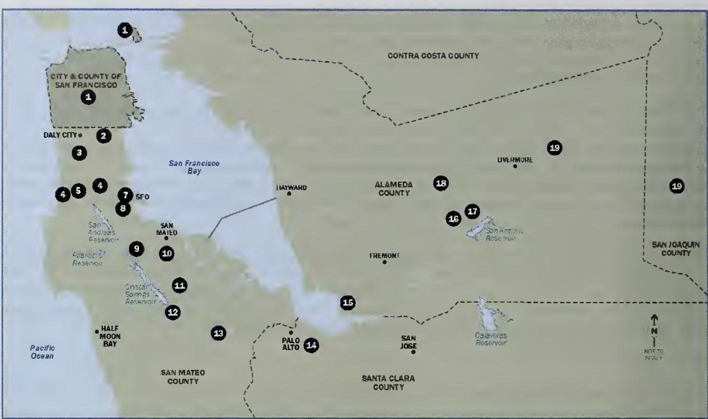
The San Francisco Bay Area as a whole has a Mediterranean climate. In the City and its vicinity, summers are cool and winters are mild with infrequent rainfall. Temperatures average 57 degrees Fahrenheit annually, ranging from the mid-40s in the winter to the upper 60s in the late summer. Strong onshore flow of wind in the summer keeps the air cool, generating fog through September. The warmest temperatures generally occur in September and October. Rainfall averages about 22 inches per year and is generally confined to the "wet" season from late October to early May.[3] Except for occasional light drizzles from thick marine stratus clouds, summers are nearly dry.

For a discussion of climate change and potential impacts, see **Section 6.1.6**.

---

[3] Average maximum and minimum temperatures and average monthly rainfall data obtained from Western Regional Climate Center, 1981-2010 data from two San Francisco monitoring stations (Mission Dolores/SF#047772 and Richmond/SF#047767). Accessed from: www.wrc[illegible]

Figure 3-3. Retail Service Area



In-City Retail Service Area

1 City and County of San Francisco

Suburban Retail Service Area

2 Residential and Non-residential Customers in Daly City

3 Cemeteries in Colma

4 Golden Gate National Cemetery

5 San Francisco County Jail #5

6 Sharp Park Golf Course

7 San Francisco International Airport

8 SFPUC Millbrae Headquarters

9 Crystal Springs Golf Course

10 Penninsula Golf and Country Club

11 Residential Customers in Redwood City

12 Filoli Center

13 Menlo Country Club

14 NASA Ames Research Center

15 Cargill Salt

16 Residential and Non-residential Customers in Sunol

17 GE Hitachi Nuclear

18 Castlewood Country Club

19 Lawrence Livermore National Laboratory (two sites)

The suburban customers shown above represent the majority of water use in the suburban retail service area, but are not comprehensive. For the purposes of the 2015 UWMP, Groveland Community Services District is considered a retail customer in the context of the 2009 Water Supply Agreement and allocating Regional Water System supplies between retail customers and Wholesale Customers. Groveland is shown in Figure 3-4.

3.2.2 Population and Demographics

As shown in **Table 3-3**, the total population in the retail service area is currently estimated to be 847,370 and is projected to increase to nearly 1.1 million by 2040. This corresponds to an average growth rate of about 1.0% per year.

Table 3-3. Retail Service Area Population

[Standardized Table 3-1 Retail: Population - Current and Projected]

Retail Service Area	Actual	Projected				
	2015	2020	2025	2030	2035	2040
In-City Retail[a]	845,602	890,400	934,800	981,800	1,032,500	1,085,700
Suburban Retail[b]	1,768	1,768	1,768	1,768	1,768	1,768
Total Retail	**847,370**	**892,168**	**936,568**	**983,568**	**1,034,268**	**1,087,468**

a County of San Francisco population for January 1, 2015 obtained from the California Department of Finance Report E-5, released May 1, 2015. County of San Francisco population projections obtained from ABAG Projections 2013.

b Actual and projected population based on the number of retail residential service connections in Redwood City, Daly City, Fremont, and Millbrae; the number of homes in Castlewood CSA; inmate population of the San Francisco County Jail #5 in San Bruno; Department of Water Resources (DWR) Population Tool for Town of Sunol; and 2000 and 2010 U.S. Census data. Methodology used to estimate population in the suburban retail service area was approved through pre-review with DWR and is detailed in **Section 5.1**. Population for Groveland CSD is not included as retail, but reported as wholesale in **Table 3-4** instead.

The retail service area, particularly the in-City portion, is highly urbanized, dense, and growing. Open space and landscaped areas are limited, as are lot sizes. Build-out is planned or already under construction at the few, large undeveloped or redevelopment areas that remain, such as Candlestick Point/Hunters Point Shipyard, Treasure Island/Yerba Buena Island, Mission Bay, and Pier 70. Most of these areas are located along the eastern shoreline of the City. The majority of current and planned development is comprised of mixed-use, multi-family residential, and commercial high-rise buildings.

Currently, the ratio of multi-family households to single family households in the City is approximately 2:1 (i.e., one third of total housing is single family). As new housing is built, the majority of which will be multi-family units, the ratio will increase to nearly 3:1 (i.e., one fourth of total housing is single family) by 2040.

Retail demand projections presented in this 2015 UWMP (**Section 4.1**) are based on demographic data and growth forecasts prepared by the California Department of Finance, Association of Bay Area Governments (ABAG), and the San Francisco Planning Department for the in-City retail service area. Additional information about demographic data sources and assumptions supporting the retail demand projections can be found in **Appendix E**.

3.3 WHOLESALE SERVICE AREA

The SFPUC sells water to 26 Wholesale Customers through the terms of the 2009 Water Supply Agreement (WSA). The SFPUC also sells water to two additional wholesale customers, Cordilleras MWC and Groveland CSD. These customers are further described below:

- **Wholesale Customers and BAWSCA:** Enabled by Assembly Bill (AB) 2058, BAWSCA was established on May 27, 2003 to represent the interests of 24 cities and water districts, as well as two other utilities in Alameda, Santa Clara and San Mateo counties that purchase water on a wholesale basis from the RWS. Sales are conducted under the terms of the WSA between the City and County of San Francisco and the Wholesale Customers, together with individual water supply contracts. Since 1970, the SFPUC has supplied approximately 65% of the total Wholesale Customers' demand. Some of the Wholesale Customers are entirely reliant on the SFPUC for their supply.

- **Cordilleras MWC:** Cordilleras MWC serves a community of 18 single family homes in Emerald Hills, located in unincorporated San Mateo County. It is not considered an urban water supplier as defined by CWC Section 10617. It is not a member of BAWSCA, and not subject to the terms of the WSA. However, Cordilleras MWC has a water supply contract with the SFPUC for 3,007 CCF (about 0.006 mgd).

- **Groveland CSD:** As described in **Section 2.4**, Groveland CSD primarily serves residential and commercial customers in Groveland, located in a semi-rural area of southern Tuolumne County. Although Groveland CSD is considered a retail customer of the SFPUC and is accounted as such in the SFPUC's contractual obligations and supply planning, the SFPUC was directed by DWR to report Groveland CSD as a wholesale customer for this 2015 UWMP update. Therefore, Groveland CSD is included in the wholesale service area for the remainder of this section. It is not a member of BAWSCA, and not subject to the terms of the WSA.

The wholesale service area encompassing the Wholesale Customers, Cordilleras MWC, and Groveland CSD, is shown in **Figure 3-4**.

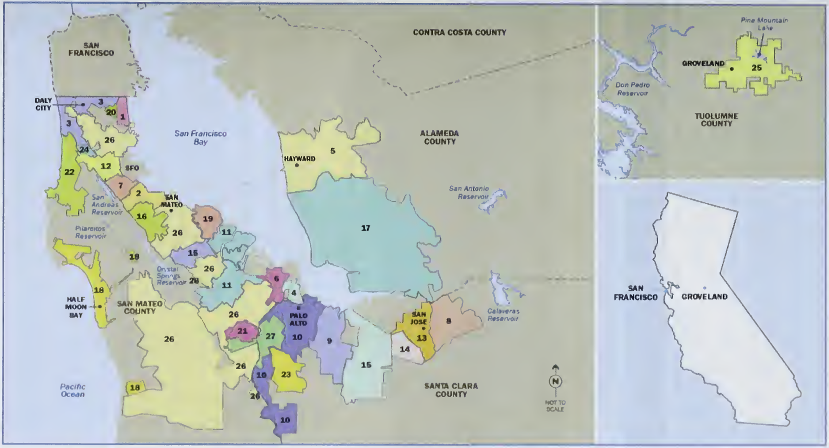
3.3.1 Climate

As described in **Section 3.2.1** for the retail service area, the San Francisco Bay Area as a whole has a Mediterranean climate. Varied topography throughout the Bay Area creates numerous microclimates dependent upon elevation, proximity to the Bay or coast, orientation with respect to the ocean, and wind patterns. These microclimates also result in different rainfall amounts and evapotranspiration rates. However, in general, the Wholesale Customers and Cordilleras MWC experience a climate similar to the in-City retail service, except for customers located in the southern and inland regions that tend to experience warmer temperatures in the summer months with less incidence of fog.

Further inland in the Sierra Nevada foothills, Groveland CSD experiences hot, dry summers and mild winters. Most of Groveland CSD's service area is located at elevations of 2,800 to 3,300 feet, so are not subjected to the long, severe winters and heavy snowfall that are experienced at higher elevations above 5,000 feet.

For a discussion of climate change and potential impacts, see **Section 6.1.6**.

Figure 3-4. Wholesale Service Area



MUNICIPALITIES

1 City of Brisbane
2 City of Burlingame
3 City of Daly City
4 City of East Palo Alto
5 City of Hayward
6 City of Menlo Park
7 City of Millbrae
8 City of Milpitas
9 City of Mountain View
10 City of Palo Alto
11 City of Redwood City
12 City of San Bruno
13 City of San Jose[a]
14 City of Santa Clara[a]
15 City of Sunnyvale
16 Town of Hillsborough

WATER PURVEYING DISTRICTS

17 Alameda County Water District
18 Coastside County Water District
19 Estero Municipal Improvement District
20 Guadalupe Valley Municipal Improvement District
21 Mid-Peninsula Water District
22 North Coast County Water District
23 Purissima Hills Water District
24 Westborough Water District
25 Groveland Community Services District[b]

OTHER ENTITIES

26 California Water Service Company[c]
27 Stanford University
28 Cordilleras Mutual Water Company[d]

a The SFPUC provides water on an interruptible basis to fixed service areas in the northern portions of the Cities of San Jose and Santa Clara

b Groveland Community Services District is not a member of BAWSCA. For the purposes of the 2015 UWMP, Groveland is considered a retail customer in the context of the 2009 Water Supply Agreement and allocating Regional Water System supplies between retail customers and Wholesale Customers. However, Groveland is accounted for as a wholesale customer in the standardized tables provided in **Appendix B**

c California Water Service Company, an investor-owned utility, provides water service to four separate districts: Bear Gulch (Atherton vicinity), San Carlos/San Mateo, South San Francisco, and Skyline County Water District

d Cordilleras Mutual Water Company is not a member of BAWSCA

3.3.2 Population and Demographics

As shown in **Table 3-4**, the total population in the wholesale service area is currently estimated to be about 1.8 million and is projected to increase to over 2.2 million by 2040. This corresponds to an average growth rate of about 0.9% per year.

Compared to the retail service area, the majority of which is comprised of the City, the wholesale service area is less dense and populated, but still fairly urbanized and built out. Single family homes are more prevalent and lot sizes are larger.

Table 3-4. Wholesale Service Area Population

[Standardized Table 3-1 Wholesale: Population - Current and Projected]

Wholesale Service Area	Actual	Projected				
	2015	2020	2025	2030	2035	2040
BAWSCA Member Agencies[a]	1,797,393	1,879,796	1,968,717	2,058,792	2,153,785	2,238,881
Cordilleras MWC[b]	64	64	64	64	64	64
Groveland CSD[c]	3,440	3,483	3,527	3,571	3,616	3,661
Total Wholesale	**1,800,897**	**1,883,343**	**1,972,308**	**2,062,427**	**2,157,465**	**2,242,606**

a Data provided by BAWSCA and reflect projections as anticipated to be reported in each agency's individual 2015 UWMP (subject to change).

b Data provided by Cordilleras MWC.

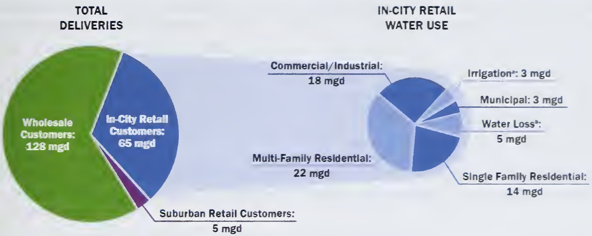
c Data provided by Groveland CSD; currently draft and under review as part of its UWMP process.

SECTION 4: SYSTEM DEMANDS

This section describes and quantifies the current and projected water uses within the SFPUC's retail and wholesale service areas. Retail demand projections are based on recent demographic information and a detailed analysis of water use characteristics. Wholesale demand projections for RWS supplies were developed by the wholesale customers. Note that the terms "use," "demand," and "consumption" are used interchangeably Additionally, water loss is included in total retail demands unless otherwise noted.

As described previously, approximately two thirds of the SFPUC's water supply is delivered to wholesale customers, and the remaining one third is delivered to retail customers. In 2015, the SFPUC delivered approximately 196 mgd of RWS supplies to its entire water service area, with an additional 2 mgd in local groundwater and recycled water to retail customers. **Figure 4-1** shows what portions were delivered to wholesale and retail (in-City and suburban) customers. Approximate water use by sector in the in-City retail service area is also shown in **Figure 4-1**.

Figure 4-1. Total Deliveries and In-City Retail Water Use in 2015



a This data is from dedicated irrigation accounts only, and does not include irrigation use from water accounts that jointly serve both indoor and outdoor demands. Irrigation use includes use of local groundwater and recycled water.

b Water loss includes apparent (e.g., fire fighting, pipe flushing, street cleaning) and real (e.g., distribution system leaks, main breaks) losses.

Note that Groveland CSD is accounted for differently between this section of the 2015 UWMP and the corresponding standardized tables in **Appendix B**. This section includes Groveland CSD the estimation of retail demands because, in the context of RWS supply allocations between the SFPUC and its Wholesale Customers. Groveland CSD is a retail customer. Where retail demands are subsequently compared to retail supplies in **Section 7.5**, Groveland CSD will be accounted for in both the demand and supply projections. In contrast, the standardized tables in **Appendix B** include Groveland CSD in the estimation of wholesale demands, as directed by DWR and explained in **Section 2.4**.

4.1 RETAIL DEMANDS

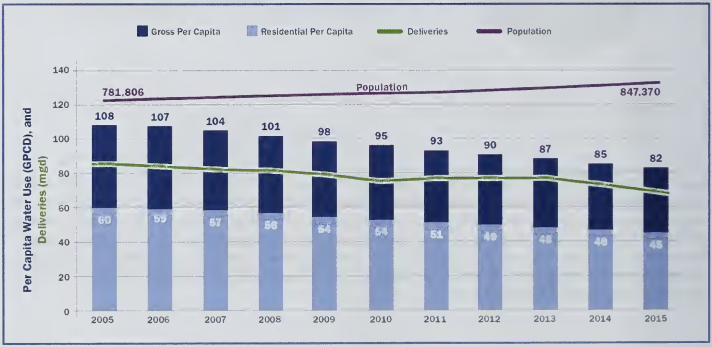
4.1.1 Current Retail Demands

Water use within San Francisco (i.e., the in-City retail service area) continues to be among the lowest in the State and below historic consumption. Both total consumption and per capita water use (i.e., gallons of water consumed per person per day [GPCD]) have been on a general decline since the mid-1970s. Many factors have contributed to this reduction in water use, including significant changes to the mix of industrial and commercial businesses and their associated water demand, and the general characteristics of water use by San Franciscans. In particular, the severe droughts of 1976-77 and 1987-92, changes in plumbing codes, and conservation programs (either voluntarily embraced by residents and businesses or mandated by the City), have affected water demands. The magnitude and duration of the effects of the current drought on demands are unknown. However, per capita water use is expected to increase after this year if the drought ends and some level of discretionary water use rebounds.

As illustrated in **Figure 4-2**, per capita water use and deliveries have declined over the past decade. Per capita water use is presented on either a gross (i.e., water use by all sectors) or residential (i.e., water use by the residential sector only) basis. Currently, gross and residential per capita water use by in-City retail customers are 77 and 45 GPCD, respectively. Taking suburban retail customers into account, gross and residential per capita water use by all retail customers are 82 and 45 GPCD, respectively. These per capita rates are among the lowest in the State.

Since the summer of 2014, the SFPUC has reported total water production and residential per capita water use on a monthly basis to the SWRCB in compliance with its emergency conservation regulations. The monthly per capita rates are consistently among the lowest reported by urban water suppliers in the State.

Figure 4-2. Trends in Retail Deliveries and Use



Total retail demand in 2015 was at a historic low of 70.1 mgd, much lower than anticipated in the 2010 UWMP update. Of this demand, in-City retail customers used approximately 65.6 mgd (94% of total retail demand), of which 1.5 mgd was met with groundwater, and 0.2 mgd was met with recycled water, and the remainder was met with RWS supplies. Suburban retail customers used approximately 4.5 mgd (6% of total retail demand), of which 0.7 mgd was met with groundwater and the remainder was met with RWS supplies. Total retail water loss, including both real and apparent losses, was estimated to be 5.3 mgd.

Much of the decrease in demand can be attributed to the strong response by retail customers to local and Statewide directives for conservation during the current, unprecedented drought. These directives included the mandatory reduction in outdoor water use imposed by both the SWRCB and SFPUC in the summer of 2014 In addition, the SFPUC has called on all its customers to reduce water use by 10% system-wide since January 2014. For more information about local and State mandates related to the current drought, see **Section 8.2** and **Appendix F**.

The SFPUC's retail demands are generally tracked and projected by each of the major sectors below. Current retail demands for each of these sectors are shown alongside projected demands in **Table 4-1**.

- **Single Family Residential:** Single family households comprise approximately one third of the total households in the City, and this proportion is declining. Approximately 40% of all water delivered to the residential sector is used by single family households. This sector represents approximately 20% of total retail demand. Due to the Bay Area's moderate climate and high density housing, especially in the City, residential water use is used almost entirely indoors. Outdoor water use is estimated to be less than 10% of single-family residential use, on average.

- **Multi-Family Residential:** Multi-family households include apartments, condominiums, and townhouses. This sector comprises approximately two thirds of the total households in the City, and this proportion is increasing. Approximately 60% of the total water delivered to the residential sector is used by multi-family households. This sector represents approximately 30% of total retail demand. Average outdoor water use is limited since outdoor space for multi-family households are generally limited to patios and shared spaces, if any.

- **Non-residential:** This sector includes all sectors of water users not designated as residential and includes commercial, industrial, institutional, and municipal uses, as well as irrigation through dedicated meters. Non-residential water use represents approximately 40% of total retail demand.

- **Water Loss:** Water loss is defined as the difference between the quantity of water supplied to customers and the quantity of water actually consumed by customers. It is comprised of both apparent losses and real losses. Water loss typically represents less than 10% of total retail demand. For more information on water loss, see **Section 4.1.3** and **Appendix G**.

4.1.2 Projected Retail Demands

4.1.2.1 Methodology Used to Project Retail Demands

Up until 2015, retail demands and conservation potential have been projected using the SFPUC Retail Demand Model. This model, which was initially developed in 2004, uses end-use methodology to forecast both demands and conservation savings. The model was updated over the years to incorporate the latest growth forecasts, extend the projection period, reflect changes to the SFPUC's conservation programming, incorporate the latest codes and ordinances, and to respond to a variety of other needs. Projections from this model have been used in the 2005 and 2010 updates to the UWMP, as well as in the SFPUC's corresponding Retail Water Conservation Plan (Conservation Plan) updates.

The Conservation Plan provides an overview of the retail water conservation program, the factors that shaped the program, estimated water savings, and the program's effect on the overall retail water demand forecast. The Conservation Plan is a key element of the SFPUC's water supply management and planning, and is updated every five years to coincide with each UWMP update. The Conservation Plan may be accessed online at conserve.sfwater.org.

For the 2015 update to the UWMP and Conservation Plan, the SFPUC developed a new set of models that incorporate socioeconomic factors to project demands through 2040. By including socioeconomic factors, the models are able to capture a more complete demand picture. This demand forecasting methodology is becoming more prevalent among urban water utilities and managers. The new set of models is comprised of the following components:

- Econometric models are used to project in-City single family residential, multi-family residential, and commercial/industrial demands. Detailed information about these models is provided in **Appendix E**.

- Other in-City retail demands and suburban retail demands are estimated based on historical consumption, and supplement the demands projected by the econometric models. These supplemental demands are assumed to be constant through 2040 since no significant growth is anticipated among these sectors.

- An end-use-based water savings accounting model is used to project savings from passive (i.e., savings due to plumbing codes and standards) and active (e.g., savings due to the retail water conservation program) conservation to adjust both in-City and suburban retail demands. This model is customized for the SFPUC from the Alliance for Water Efficiency Water Conservation Tracking Tool. Additional information about this model, the SFPUC Water Conservation Tracking Model, is provided in **Appendix H**. Passive and active conservation savings are quantified in the Conservation Plan.

As with the previous retail demand models, the new set of models for 2015 segregates demands into three sectors of water use: single family residential, multi-family residential, and non-residential. See **Section 4.1.1** for a description of water use by each of these sectors. Water loss is forecasted separately and is described in **Section 4.1.3**.

The new set of models relies on household and employment forecasts provided by the San Francisco Planning Department's Land Use Allocation (LUA) 2012. The LUA 2012 forecasts are a City-specific refinement of ABAG's growth forecasts, ABAG Projections 2013, which reflect the growth that is assumed in ABAG's Plan Bay Area and Sustainable Communities Strategy Jobs-Housing Connections Scenario.

Previously, non-residential demand projections from the SFPUC Retail Demands and Conservation Potential Model accounted for employment distributed across a variety of sectors, such as manufacturing, transportation, trade, finance, and government. In the new set of models for 2015, non-residential demands are aggregated and based only on total employment, not sector-specific characteristics.

Separately, Groveland CSD prepared its own demand projections for use in its 2015 UWMP update. The projected demands were estimated by multiplying projected population by the base daily per capita water use (130 GPCD) as reported in Groveland CSD's 2010 UWMP. These projections were provided to the SFPUC to report as part of wholesale demands in the standardized tables (see **Appendix B**). However, in the body of this 2015 UWMP, Groveland CSD's demands are included in retail demands. These demand projections are draft and under review as part of Groveland CSD's UWMP process.

4.1.2.2 Retail Demand Projections by Sector

Table 4-1 presents the updated retail demand projections by sector for 2020 through 2040. The updated projections result in a total retail demand of 85.9 mgd in 2035, which is 5.0 mgd higher than the corresponding projection in the 2010 UWMP. (The 2010 UWMP did not include projections for 2040.)

Table 4-1. Retail Demands (mgd)

[Standardized Table 4-1 Retail: Demands for Potable and Raw Water - Actual]
[Standardized Table 4-2 Retail: Demands for Potable and Raw Water - Projected]
[Standardized Table 4-3 Retail: Total Water Demands]
[Standardized Table 6-4 Retail: Current and Projected Recycled Water Direct Beneficial Uses Within Service Area]

	Actual[a]	Projected[b]				
Retail Sector or Use Type	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
In-City Retail						
Single Family Residential	14.5	15.5	16.3	17.8	19.5	21.1
Multi-Family Residential	22.2	22.1	22.8	24.0	25.0	26.2
Non-residential	23.6	28.9	28.9	29.5	30.4	31.6
Water Loss[c]	5.3	6.0	6.0	6.0	6.0	6.0
Subtotal In-City Retail Demand	**65.6**	**72.5**	**74.0**	**77.3**	**80.9**	**84.9**
Suburban Retail						
Single Family Residential[d]	0.1	0.1	0.1	0.1	0.1	0.1
Non-residential	4.1	4.4	4.4	4.4	4.4	4.4
Groveland CSD[e]	0.3	0.5	0.5	0.5	0.5	0.5
Water Loss[c]	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal Suburban Retail Demand	**4.5**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
Total Retail Demand	**70.1**	**77.5**	**79.0**	**82.3**	**85.9**	**89.9**

a Actual consumption data are obtained from customer billing data.

b Projected single family residential, multi-family residential, and non-residential demands are obtained from the SFPUC Water Conservation Tracking Model and reflect both passive and active conservation.

c Water losses include both apparent and real losses. Suburban retail water losses are considered to be negligible. Estimate of actual water loss in 2015 is based on draft audit, currently under review.

d Suburban retail residential demands are for single family only as no multi-family residential buildings are served

e Groveland CSD is accounted for as a retail customer for the purpose of this table and subsequent retail supply and demand comparisons. Demand projections were provided by Groveland CSD based on its population projections and assumed per capita water use of 130 GPCD (projections are draft and under review as part of its UWMP process). In the corresponding standardized tables in **Appendix B**, Groveland CSD is not reported as retail, but rather wholesale.

While the overall demand has continued to decline through 2015 due in large part to increasingly more efficient plumbing fixtures, projections show that by around 2018[4] total retail demand will reach a point at which conservation savings will no longer outpace anticipated population and job growth; thus, demand is forecasted to increase steadily through 2040. After accounting for the projected conservation savings, the retail demand (excluding water loss) is projected to increase by about 29%, from 64.8 mgd in 2015, to 83.9 mgd in 2040. In the absence of water conservation efforts, retail demand (excluding water loss) would be projected to increase by 41% over the next 25 years, from 74.2 mgd in 2015 to 104.5 mgd in 2040. Both the projected demands and conservation savings are conservative as unanticipated new building codes, standards, and programs that increase water efficiency and reduce water use will likely be implemented. A closer analysis of the estimated conservation savings is provided in the Conservation Plan. Sector-specific observations are summarized below:

- **Single Family Residential:** Single family residential water use is projected to increase by 45% between 2015 and 2040. In-City single family residential demands are modeled as a function of socioeconomic factors that include water price, household income, residential density, precipitation, and temperature. Single family residential demand is highly responsive to household income. As household income is projected to increase, water use also increases. Single family households also occupy larger lot sizes per capita that other types of developments and often have landscaping, resulting in greater outdoor water than in the multi-family residential sector.

- **Multi-Family Residential:** Multi-family residential water use is projected to increase by 18% between 2015 and 2040. In-City multi-family residential demands are modeled as a function of the price of water. However, compared to the response of single family residential demands, multi-family residential demands are not as responsive to price. Because multi-family households have relatively little outdoor water use and a variety of shared appliances, customers in this sector are more likely to direct their consumption toward higher priority uses rather than discretionary uses, such as landscaping. In addition, occupants of some multi-family households have lower incomes than single family households, and therefore may have fewer water-using appliances, resulting in less discretionary water use.

- **Non-residential:** Non-residential water use is projected to increase by 30% between 2015 and 2040. While the growth in in-City non-residential demands is directly related to the growth in employment, commercial and industrial water demands also reflect socioeconomic factors including price, precipitation, and temperature. As the price of water increases, the amount of water consumed per employee decreases.

- **Water Loss:** Water loss is projected to be a constant 6.0 mgd for planning purposes. More information on water loss projections is provided in the next section.

4.1.3 Retail Distribution System Water Losses

Water loss is defined as the difference between the quantity of water supplied to customers and the quantity of water actually consumed by customers. It is comprised of (1) apparent losses, which include unbilled, authorized consumption for operational uses (e.g., fire fighting, pipe flushing, street cleaning, dust control, and low pressure fire hydrant use) and all types of inaccuracies associated with customer metering, data handling, and theft or illegal use; and (2) real losses, which include all water physically lost due to distribution system leaks, breaks, overflows, and other unbilled, unauthorized consumption. In short, real losses are equivalent to distribution system water losses. Water loss in the retail service area ranges from 5 to 7 mgd annually, which is typically less than 10% of total retail demand.

---

[4] Retail demand projections for 2018 are not provided in this 2015 UWMP, but are available in the 2015 Retail Water Conservation Plan.

The SFPUC conducted a water audit for its in-City distribution system using the American Water Works Association (AWWA) M36 method and associated worksheets. While the results of the audit are currently under review, water loss in 2015 was preliminarily determined to be 5.3 mgd, of which 4.0 mgd was attributed to real losses. The draft AWWA worksheets are provided in **Appendix G**.

For its planning purposes, the SFPUC projects water loss to be a flat 6.0 mgd through 2040. This estimate reflects, among others, the anticipation of leaks and breaks due to aging infrastructure, continuance of system flushing after the drought, and active management of losses (described below). Real and apparent losses are not projected separately. Therefore, projections for water loss, rather than just the real loss portion, is used as a conservative estimate and reported as such in this 2015 UWMP.

Nearly all of the SFPUC's suburban retail customers are located immediately off of RWS transmission pipelines. Therefore, real losses in the suburban retail service area are assumed to be negligible. As described in **Section 3.1.5.2**, the SFPUC operates the Castlewood Well System and the Town of Sunol domestic water system. However, the extent of distribution in the Castlewood Well System is limited from the well field to the control tank and reservoir. There is no master meter to the Town of Sunol, so loss in the Town of Sunol system cannot be directly measured. The primary source of water loss in the Town of Sunol is system maintenance flushing, which would occur regularly at a rate of 10,000 gallons per week for 50 weeks per year, or roughly 0.001 mgd (1.5 AF). However, due to the current drought, system flushing has only been conducted as needed (e.g., customer complaints, known bad spots with poor flow or buildup) starting in December 2014. Therefore, water loss due to flushing during FY 2014-15 was substantially less than 0.001 mgd. In addition, approximately 300,000 gallons of water were lost during the commissioning and disinfection of two new storage tanks, amounting to less than 0.001 mgd (0.9 AF) during FY 2014-15. Cumulatively, these losses in the suburban retail service area are considered to be negligible.

The SFPUC manages real losses through its Automated Water Meter Program and Linear Assets Management Program. Deployment of the Automated Water Meter Program began in the spring of 2010 to upgrade all in-City retail water meters with wireless advanced metering technology, and is nearly complete. The Linear Assets Management Program replaces and renews distribution system pipelines and customer service connections for approximately 1,250 miles of drinking water mains in the City. More information about management of retail system losses is provided in **Section 9.2.5**.

4.1.4 Demands of Lower Income Households

The Act requires water suppliers to separately estimate future demands for lower income households (i.e., those with less than 80% of the area median income [AMI]). This section documents the SFPUC's best effort to do so. However, please note that the SFPUC does not use this estimate for any planning purposes. Projected water use by lower income households is estimated by multiplying the planned future housing units for lower income residents by the average number of persons per household and the estimated per capita water use. This analysis, detailed below, is only performed for the in-City retail service area as lower income demands are primarily located in the City.

As described in the 2014 Housing Element of the San Francisco General Plan[5], ABAG, in coordination with the California State Department of Housing and Community Development, determine the Bay Area's regional housing need based on regional trends, projected job growth, and existing needs. San Francisco's fair share of the regional housing need for January 2015 through June 2022 was calculated as 28,870 units, or about 3,850 units per year total. This estimate includes units for all adjusted median income (AMI) categories: very low (0-50% of AMI), low (51-80% of AMI), moderate (81-120% of AMI), and above moderate (over than 120% of AMI)

[5] The 2014 Housing Element may be accessed at: www.sf-planning.org/ftp/general_plan. Housing needs data are provided in Table I-38 of that document

categories. The corresponding annual production goal for the very low and low income categories is 831 and 619 units, respectively, for a total of 1,450 lower income housing units per year. Thus, assuming a consistent number of units are built each year, approximately 7,250 lower income housing units are planned to be built over the next five years between 2015 and 2020. This estimate accounts for both single family and multi-family residential units; projections for each residential sector are not available.

Based on ABAG Projections 2013, the average persons per household would be approximately 2.28 in 2020. As such, it is estimated that approximately 16,530 residents (2.28 persons per household multiplied by 7,250 units) will occupy planned lower income housing units by 2020. As presented later in **Section 5.4**, per capita water use in the retail service area is projected to be approximately 86 GPCD in 2020. Water use in planned lower income housing units is therefore estimated to be approximately 1.4 mgd (16,530 residents multiplied by 86 GPCD) in 2020.

This estimate of lower income water demand is reflected in the retail demand projections presented in **Table 4-1**. Lower income housing growth and demands have always been included in the SFPUC's retail demand projections and, subsequently, its related planning efforts.

4.2 WHOLESALE DEMANDS

Out of its 28 wholesale customers, the SFPUC provides water to 26 Wholesale Customers in San Mateo, Alameda and Santa Clara Counties under the 2009 Water Supply Agreement (WSA) and associated individual contracts with each Wholesale Customer. Collectively, these customers receive over two thirds of the SFPUC's supply. Of the 26 Wholesale Customers, 13 rely on the SFPUC for 95% or more of their total supply; eight rely on the SFPUC for 100% of their total supply.

In addition to the 26 Wholesale Customers, the SFPUC also provides water on a wholesale basis to Cordilleras MWC in San Mateo County and Groveland CSD in Tuolumne County. Cordilleras MWC relies entirely on the SFPUC for its supply, and Groveland CSD relies on the SFPUC for the majority of its supply.

The demands of these two wholesale customers are small compared to the collective demands of the other Wholesale Customers.

4.2.1 Wholesale Water Contractual Obligations

The following sections describe the water supply contracts that the SFPUC has with its Wholesale Customers.

4.2.1.1 2009 Water Supply Agreement and 1984 Settlement Agreement and Master Water Sales Contract

The predecessor to the WSA, the 1984 Settlement Agreement and Master Water Sales Contract (1984 Agreement) established the "Supply Assurance" of 184 mgd to the Wholesale Customers. The 1984 Agreement expired on June 30, 2009. In July 2009, the SFPUC entered into the WSA, a 25-year agreement that describes the current contractual relationship between the SFPUC and its Wholesale Customers. The WSA continued the Supply Assurance in favor of the Wholesale Customers. The 184 mgd Supply Assurance is perpetual and survives the expiration of the WSA.

The Supply Assurance is subject to reduction due to drought, scheduled maintenance activities, and emergencies. The Supply Assurance includes the demands of the City of Hayward and 23 additional Wholesale

Customers (representing 24 of the 26 Wholesale Customers).[6] The Cities of San Jose and Santa Clara do not have an allocated share of the Supply Assurance due to their temporary, interruptible status under the 1984 Agreement and the WSA.

The Supply Assurance is allocated between 23 Wholesale Customers using allocations called "Individual Supply Guarantees" (ISGs). The ISGs represent each Wholesale Customer's share of the 184 mgd Supply Assurance. Separately, the City of Hayward has an unspecified supply allocation due to the terms of a 1962 individual water supply contract with the SFPUC that did not contain a fixed allocation of water. The City of Hayward's unspecified water supply allocation is included in the Supply Assurance as the difference between 184 mgd and the sum of the other Wholesale Customers' ISGs. In the event that Hayward's water use exceeds its unspecified water supply allocation, the 23 Wholesale Customers with ISGs would be required to reduce their individual ISGs to accommodate the demands of Hayward.

Each Wholesale Customer also has an individual agreement with the SFPUC that outlines the locations of service connections, service area maps, and other customer-specific details.

The WSA also describes the temporary limitation on water sales through 2018 established by the Phased WSIP (see **Section 6.1.3** for a description of the Phased WSIP).The SFPUC established an "Interim Supply Limitation" (ISL) to limit water sales from the RWS watersheds (referred to as the RWS for the remainder of this document) to an average annual amount of 265 mgd through December 31, 2018. The WSA describes the distribution of the ISL, which is allocated as follows between retail customers and Wholesale Customers:

- Wholesale supply allocation: 184 mgd
- Retail supply allocation: 81 mgd[7]

If the SFPUC projects that the ISL will not be met by June 30, 2018 as a result of Wholesale Customers' projected use exceeding 184 mgd, the SFPUC may issue a conditional five-year notice of interruption or reduction in supply of water to San Jose and Santa Clara.

The Interim Supply Allocations (ISAs), which were established by the SFPUC in December 2010, refer to each Wholesale Customer's share of the ISL. The Wholesale Customers' collective allocation of 184 mgd includes the demands of the Cities of Hayward, San Jose, and Santa Clara. Along with the ISL, the ISAs will also expire on December 31, 2018, but the ISAs do not affect the Supply Assurance or ISGs. The ISGs and ISAs are listed in both **Table 4-2** and **Table 4-3**.

As an incentive to keep RWS deliveries below the ISL of 265 mgd, the SFPUC adopted an "Environmental Enhancement Surcharge" for collective deliveries in excess of the ISL effective at the beginning of FY 2011-12. This volume-based surcharge would be unilaterally imposed by the SFPUC on individual Wholesale Customers and San Francisco retail customers, when an agency's use exceeds its ISA and when sales of water to the Wholesale Customers and San Francisco retail customers, collectively, exceed the ISL of 265 mgd. Actual charges would be determined based on each agency's respective amount(s) of excess use over its ISA. To date, no Environmental Enhancement Surcharges have been levied.

[6] The Supply Assurance as expressed in the WSA includes the City of Hayward and 24 additional Wholesale Customers. Skyline County Water District is now operated by the California Water Service Company.

[7] As explained in **Section 2.4**, Groveland CSD is considered a retail customer of the SFPUC. Thus, RWS supplies to Groveland CSD are accounted for in the retail supply allocation of 81 mgd.

4.2.1.2 2018 Water Supply Decisions

The WSA requires the SFPUC to complete necessary review under the California Environmental Quality Act (CEQA) by December 31, 2018 to support two actions that will affect future water supply planning and development:

- Whether or not to make the Cities of San Jose and Santa Clara permanent customers to the extent that the SFPUC determines that long- term RWS supplies are available, and

- Whether or not to provide water in excess of the Supply Assurance to meet the Wholesale Customers' projected future water demands until the year 2030, and whether to offer a corresponding increase in the Supply Assurance as a result of this determination.

Since the adoption of the Phased WSIP, permitting requirements for the Calaveras Dam Replacement Project and Lower Crystal Springs Dam Improvements Project resulted in additional instream flow requirements that reduced the yield of the RWS. Customer demand projections through 2040 are also below levels previously anticipated. To establish a water supply planning framework for the planning period of 2019 through 2035, the SFPUC developed the 2035 Water Management Action Plan (WaterMAP). The WaterMAP provides necessary information to address key water supply decisions. The water supply program developed as a result of the policy decisions will enable the SFPUC to continue to meet its commitments and responsibilities to the Wholesale Customers and retail customers, consistent with the priorities of the SFPUC. The WaterMAP and ensuing decision-making process are further described in **Section 7.7.1**. At this time, and for purposes of long-term planning, it is assumed that deliveries from the RWS to the Wholesale Customers will not be in excess of the 184 mgd Supply Assurance.

4.2.2 Wholesale Demands

Similar to retail demands, wholesale demands have been declining and are currently at a historic low due to the current drought. As shown in both **Table 4-2** and **Table 4-3**, RWS supplies purchased by wholesale customers in 2015 totaled 128.0 mgd.

In 2014, BAWSCA updated the demand projections of its member agencies using a combination of two different models: an econometric (or statistical) model developed particularly for each member agency and the Demand Side Management Least Cost Planning Decision Support System (a.k.a., DSS Model). Population projections were obtained from a combination of ABAG Projections 2013, individual agency 2010 UWMPs, California Department of Finance, the U.S. Census, and agency planning documents. The forecast methodology and resulting projections are documented in BAWSCA's 2014 report titled "Regional Water Demand and Conservation Projections," and support BAWSCA's Long-Term Reliable Water Supply Strategy (Strategy). The Strategy is further described in **Section 7.4.1**. The Strategy's projections indicated that demands by the Wholesale Customers for RWS supplies through 2040 will be significantly less than anticipated at the time the Phased WSIP was adopted. For each of their individual 2015 UWMPs, some of the BAWSCA member agencies are using the projections developed for the Strategy, while others are using their own set of projections. Projected purchase requests for RWS supplies are provided in **Table 4-2** for each Wholesale Customer. Projections that are different from the Strategy's projections are noted as such.

However, to reflect the Supply Assurance described previously, this 2015 UWMP uses the Wholesale Customers' ISGs in lieu of their purchase request projections for planning purposes. It is assumed that the Supply Assurance of 184 mgd will remain, and that the Supply Assurance will not be increased. Subject to the process requirements for interruption or reduction of supply provided in Section 4.05 of the WSA, the SFPUC will continue to supply

water to the San Jose and Santa Clara on a temporary, interruptible basis. However, per the 2009 WSA, the SFPUC will be considering whether to increase the Supply Assurance and provide permanent supply to San Jose and Santa Clara as described in **Section 4.2.1**, above. It should be noted that San Jose's and Santa Clara's demands have been accommodated within the 184 mgd Supply Assurance and received supply from the SFPUC during the current drought. Alternate supplies will be identified to meet the long-term demands of San Jose and Santa Clara, subject to policy and planning decisions to be made by the SFPUC by 2018. The resulting wholesale demands based on contract obligations are shown in **Table 4-3**.

Regarding the two additional wholesale customers, demand projections for Cordilleras MWC are based on knowledge of the small, residential-only service area where no growth is anticipated. As noted earlier, demand projections for Groveland CSD are presented as part of retail demands in **Table 4-1** in the body of this 2015 UWMP, but as part of wholesale demands in the corresponding standardized tables in **Appendix B**.

4.2.3 Wholesale Distribution System Losses

For this 2015 UWMP, the SFPUC conducted a water audit of its wholesale transmission system for the first time. Using the AWWA M36 method and associated worksheets (**Appendix I**), the audit resulted in a negative water loss value -0.5 mgd, and is therefore considered to be inconclusive. However, this audit serves as an informative initial assessment to which future audits may be compared.

Prior to the audit, the SFPUC has commonly observed that the volume sold exceeds the volume supplied to wholesale customers. It is possible that established data collection practices could not completely capture irregular system operations during implementation of numerous WSIP projects and the current drought, resulting in the observed imbalance. If an imbalance continues after WSIP is completed, determining its source may require frequent and detailed assessments of the transmission system, such as on a monthly or quarterly basis. Water loss will continue to be addressed through asset management, which is described in **Section 9.3.4**. In addition, implementation of an advanced metering system for wholesale customers is nearly complete and will increase the SFPUC's ability to detect and repair losses. The wholesale advanced metering system is described in **Section 9.3.1**.

4.3 CLIMATE CHANGE IMPACTS TO DEMAND

While the effects of climate change on demand are not certain, it can be anticipated that the warmer temperatures and altered rainfall patterns associated with climate change would lead to greater water demands for irrigation and cooling. Compared to the rest of the State, irrigation demands in the SFPUC's service area are relatively low due to the dense urban environment, especially in the City. The potential increase in irrigation demand is low. However, the need for water to support cooling systems could increase more substantially given the growing number of high-rise buildings and large office campuses in the City and rest of the Bay Area. For additional discussion of climate change and potential impacts to water supply, see **Section 6.1.6**.

Table 4-2. Wholesale Purchase Requests (mgd)

[Standardized Table Not Applicable]

Wholesale Customer	ISG[a]	ISA[b]	Actual 2015 Purchases[c]	Purchase Request[d]				
				2020	2025	2030	2035	2040
Alameda County Water District	13.76	13.76	7.96	7.68	*8.90*	*9.64*	*9.89*	*10.06*
City of Brisbane / Guadalupe Valley Municipal Improvement District[e]	0.98	0.96	0.60	0.78	0.95	0.94	0.94	0.94
City of Burlingame	5.23	4.97	3.67	*4.94*	*5.01*	*5.10*	*5.21*	*5.42*
California Water Service Company	35.68	35.68	29.05	*33.42*	*33.46*	*33.79*	*34.24*	*34.79*
Coastside County Water District	2.18	2.18	1.53	1.70	1.73	1.77	2.03	2.03
City of Daly City	4.29	4.29	3.32	*4.29*	*4.29*	*4.29*	*4.29*	*4.29*
City of East Palo Alto	1.96	1.96	1.57	*2.01*	*2.14*	*2.30*	*2.54*	*3.05*
Estero Municipal Improvement District	5.90	5.85	3.98	*4.22*	*4.21*	*4.18*	*4.19*	*4.20*
City of Hayward	22.08	22.92	13.60	21.52	22.8	23.58	24.18	25.38
Town of Hillsborough	4.09	3.72	2.63	3.09	3.05	3.02	3.00	2.99
City of Menlo Park	4.46	4.1	2.63	*3.67*	*3.84*	*4.02*	*4.22*	*4.42*
Mid-Peninsula Water District	3.89	3.71	2.53	3.18	3.22	3.23	3.27	3.30
City of Millbrae	3.15	3.13	1.91	2.56	2.63	2.71	2.82	2.93
City of Milpitas	9.23	8.96	5.24	7.69	*8.20*	*8.79*	*8.79*	*8.79*
City of Mountain View	13.46	11.43	7.61	*9.70*	*8.92*	*9.13*	*9.37*	*9.65*
North Coast County Water District	3.84	3.67	2.92	3.04	3.03	3.01	2.99	2.98
City of Palo Alto	17.08	14.7	9.57	*10.60*	*10.20*	*9.90*	*9.70*	*9.50*
Purissima Hills Water District	1.63	1.63	1.65	1.78	1.75	1.72	1.71	1.71
City of Redwood City	10.93	10.88	8.01	*9.97*	*10.25*	*10.36*	*10.54*	*10.79*
City of San Bruno	3.25	2.65	1.31	2.38	2.69	3.03	3.25	3.25
Stanford University	3.03	2.91	2.00	*1.90*	*2.10*	*2.20*	*2.40*	*2.70*
City of Sunnyvale	12.58	10.59	7.79	*9.93*	*10.95*	*10.95*	*10.95*	*10.95*
Westborough County Water District	1.32	1.08	0.68	0.81	0.79	0.77	0.76	0.74
Cordilleras Mutual Water Company[g]	—	—	0.01	0.01	0.01	0.01	0.01	0.01
Subtotal Permanent Customer Purchase Requests	**184.0**	**184.0**	**121.8**	**150.0**	**155.1**	**158.4**	**161.3**	**164.9**
City of San Jose[f]	0.00	4.13	4.49	*4.50*	*4.50*	*4.50*	*4.50*	*4.50*
City of Santa Clara[f]	0.00	4.13	1.77	*4.50*	*4.50*	*4.50*	*4.50*	*4.50*
Total Wholesale Purchase Requests[h]	**—**	**—**	**128.0**	**159.0**	**164.1**	**167.4**	**170.3**	**173.9**

a Individual Supply Guarantee (ISG) refers to each Wholesale Customer's share of the Supply Assurance as defined in the 2009 Water Supply Agreement (WSA). The Supply Assurance is the 184 mgd maximum annual average metered supply of water dedicated by San Francisco to public use in the wholesale service area (not including the Cities of San Jose and Santa Clara). The City of Hayward's ISG is calculated as 184 mgd less the total of permanent customer ISGs (161.92 mgd).

b Individual Supply Allocation (ISA) refers to each Wholesale Customer's share of the 265 mgd Interim Supply Limitation through 2018.

c Actual demands are equivalent to purchases as reported in customer billing data.

d Purchase requests for RWS supplies as anticipated to be reported in each agency's individual 2015 UWMP (subject to change). Projections are consistent with BAWSCA's Long-Term Reliable Water Supply Strategy, unless italicized, which indicates that the agency has updated its projections for its 2015 UWMP.

e The City of Brisbane and Guadalupe Valley Municipal Improvement District are two Wholesale Customers that are jointly operated

f Projected purchase requests for San Jose and Santa Clara are shown as they currently do not have an allocated share of the Supply Assurance due to their temporary, interruptible status under the WSA.

g Cordilleras MWC is not a member of BAWSCA, and therefore does not have an ISG or ISA.

h Groveland CSD is not accounted for as a wholesale customer for the purpose of this table and subsequent wholesale supply and demand comparisons. Refer to **Table 4-1** for Groveland CSD's current and projected demands. However, in the corresponding standardized tables in **Appendix B**, Groveland CSD is reported as wholesale rather than retail.

Table 4-3. Wholesale Contractual Obligations (mgd)

[Standardized Table 4-1 Wholesale: Demands for Potable and Raw Water - Actual]
[Standardized Table 4-2 Wholesale: Demands for Potable and Raw Water - Projected]
[Standardized Table 4-3 Wholesale: Total Water Demands]

Wholesale Customer	ISG[a]	ISA[b]	Actual 2015 Purchases[c]	Contractual Obligation[d]				
				2020	2025	2030	2035	2040
Alameda County Water District	13.76	13.76	7.96	13.76	13.76	13.76	13.76	13.76
City of Brisbane / Guadalupe Valley Municipal Improvement District[e]	0.98	0.96	0.60	0.98	0.98	0.98	0.98	0.98
City of Burlingame	5.23	4.97	3.67	5.23	5.23	5.23	5.23	5.23
California Water Service Company	35.68	35.68	29.05	35.68	35.68	35.68	35.68	35.68
Coastside County Water District	2.18	2.18	1.53	2.18	2.18	2.18	2.18	2.18
City of Daly City	4.29	4.29	3.32	4.29	4.29	4.29	4.29	4.29
City of East Palo Alto	1.96	1.96	1.57	1.96	1.96	1.96	1.96	1.96
Estero Municipal Improvement District	5.90	5.85	3.98	5.90	5.90	5.90	5.90	5.90
City of Hayward	22.08	22.92	13.60	22.08	22.08	22.08	22.08	22.08
Town of Hillsborough	4.09	3.72	2.63	4.09	4.09	4.09	4.09	4.09
City of Menlo Park	4.46	4.1	2.63	4.46	4.46	4.46	4.46	4.46
Mid-Peninsula Water District	3.89	3.71	2.53	3.89	3.89	3.89	3.89	3.89
City of Millbrae	3.15	3.13	1.91	3.15	3.15	3.15	3.15	3.15
City of Milpitas	9.23	8.96	5.24	9.23	9.23	9.23	9.23	9.23
City of Mountain View	13.46	11.43	7.61	13.46	13.46	13.46	13.46	13.46
North Coast County Water District	3.84	3.67	2.92	3.84	3.84	3.84	3.84	3.84
City of Palo Alto	17.08	14.7	9.57	17.08	17.08	17.08	17.08	17.08
Purissima Hills Water District	1.63	1.63	1.65	1.63	1.63	1.63	1.63	1.63
City of Redwood City	10.93	10.88	8.01	10.93	10.93	10.93	10.93	10.93
City of San Bruno	3.25	2.65	1.31	3.25	3.25	3.25	3.25	3.25
City of San Jose[f]	0.00	4.13	4.49	0.00	0.00	0.00	0.00	0.00
City of Santa Clara[f]	0.00	4.13	1.77	0.00	0.00	0.00	0.00	0.00
Stanford University	3.03	2.91	2.00	3.03	3.03	3.03	3.03	3.03
City of Sunnyvale	12.58	10.59	7.79	12.58	12.58	12.58	12.58	12.58
Westborough County Water District	1.32	1.08	0.68	1.32	1.32	1.32	1.32	1.32
Subtotal BAWSCA Demand	**184.0**	**184.0**	**128.0**	**184.0**	**184.0**	**184.0**	**184.0**	**184.0**
Cordilleras Mutual Water Company[g]	—	—	0.01	0.01	0.01	0.01	0.01	0.01
Total Wholesale Demand[h]	—	—	**128.0**	**184.0**	**184.0**	**184.0**	**184.0**	**184.0**

a Individual Supply Guarantee (ISG) refers to each Wholesale Customer's share of the Supply Assurance as defined in the 2009 Water Supply Agreement (WSA). The Supply Assurance is the 184 mgd maximum annual average metered supply of water dedicated by San Francisco to public use in the wholesale service area (not including the Cities of San Jose and Santa Clara). The City of Hayward's ISG is calculated as 184 mgd less the total of permanent customer ISGs (161.92 mgd).

b Individual Supply Allocation (ISA) refers to each Wholesale Customer's share of the 265 mgd Interim Supply Limitation through 2018

c Actual demands are equivalent to purchases as reported in customer billing data.

d Wholesale Customer ISGs are shown in lieu of purchase request projections, which are shown in **Table 4-2**

e The City of Brisbane and Guadalupe Valley Municipal Improvement District are two Wholesale Customers that are jointly operated

f Projected purchase requests for San Jose and Santa Clara are shown as they currently do not have an allocated share of the Supply Assurance due to their temporary, interruptible status under the WSA

g Cordilleras MWC is not a member of BAWSCA, and therefore does not have an ISG or ISA

h Groveland CSD is not accounted for as a wholesale customer for the purpose of this table and subsequent wholesale supply and demand comparisons. Refer to **Table 4-1** for Groveland CSD's current and projected demands However, in the corresponding standardized tables in **Appendix B**, Groveland CSD is reported as wholesale rather than retail.

This page intentionally left blank.

SECTION 5: RETAIL BASELINES AND TARGETS

With the adoption of the Water Conservation Act of 2009, also known as the SB X7-7, the State is required to set a goal of reducing urban water use by 20% by the year 2020. Each retail urban water supplier must determine baseline water use, expressed in gallons per capita per day, or GPCD, during their baseline period. Each supplier must also determine their target water use for the years 2015 and 2020 in order to help the State achieve the 20% reduction.

In the 2010 UWMP, a detailed analysis was performed to determine the baseline and target per capitas based on in-City retail service area population and water use. For this 2015 UWMP update, the analysis has been updated to (1) revise the population of its in-City retail service area to reflect the 2010 U.S. Census rather than the 2000 U.S. Census, and (2) include the population and water use of its suburban retail service area. This section describes each step of the analysis.

Note that water use presented in this section reflects gross water use (i.e., water use by all sectors, including water loss). A complete set of standardized SB X7-7 Verification Form tables prescribed by DWR is provided **Appendix D**. Additionally, Groveland CSD is not included in this section, as explained in **Section 2.4**.

5.1 PER CAPITA WATER USE BASELINES

As described in *Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use (For the Consistent Implementation of the Water Conservation Act of 2009)*, the Water Conservation Act of 2009 requires that each urban retail water supplier include in its UWMP an estimate of base daily per capita water use, expressed in GPCD, for a continuous multi-year base period. The CWC specifies two different base periods:

- A 10- to 15-year continuous period used to calculate baseline per capita water use per CWC Section 10608.12(b)(1) and (2).

- A continuous five-year period used to determine whether the 2020 per capita water use target meets the legislation's minimum water use reduction requirement per CWC Section 10608.12(b)(3).

Because the SFPUC's current and past recycled water use does not equal or exceed 10% of retail water demand, the 15-year baseline cannot be used. The SFPUC will utilize a 10-year baseline. Water use data from 2001 to 2010 have been used for this analysis, which is consistent with the baseline period used in the previous analysis in the 2010 UWMP.

Base daily per capita water use has been calculated for the 10-year baseline period as follows:

- **Step 1: Estimate Distribution System Area.** The distribution system area refers to the in-City and suburban retail areas, as described in **Section 3.2**.

- **Step 2: Estimate Service Area Population for Base Period.** The retail population was estimated for the period of 2001 to 2010 based on various sources depending on data availability. For the in-City retail service area, population data were obtained from the California Department of Finance for the County of San Francisco. However, the same method could not be used for the suburban retail service area since the service area does not align with municipal boundaries. Therefore, the SFPUC consulted with DWR (i.e., pre-review) on an appropriate, alternate methodology based on U.S. Census data at the census block level and persons-per-household data. Use of persons-per-household data was deemed adequate since it is assumed that all residential accounts serve single family homes in the suburban retail service area, and no multi-family residences are served. Therefore, the number of connections can be considered equivalent to number of households. For the Town of Sunol specifically, the SFPUC used the web-based DWR Population Tool since the corresponding service area was difficult to define at the census block level (output provided in **Appendix J**). The resulting retail population estimates are shown in **Table 5-1**.

- **Step 3: Calculate Gross Water Use.** Gross water use is summarized in **Table 5-2**. Gross water use is comprised of water from the SFPUC's own water supply sources delivered to all retail customers. Changes in storage were then factored in to develop gross water use. The SFPUC compiles daily flow data for the County-line, system input, and in-line meters; and daily reservoir water level data. The meters, water level sensors, and associated metering equipment are all inspected, tested, calibrated, and maintained according to the applicable meter calibration and maintenance frequency by an independent metering consultant. These include annual pitot tube tests, quarterly secondary meter equipment testing and calibration, cleaning, flushing, inspecting, and lubricating. The flow quantities are expected to be accurate and no meter error adjustment is necessary.

- **Step 4: Calculate Annual Daily Per Capita Water Use.** Annual daily per capita water use was calculated by dividing gross water use by population. Annual daily per capita water use is shown in **Table 5-2**, which is 83.9 GPCD.

- **Step 5: Calculate Base Daily Per Capita Water Use.** Base daily per capita water use is calculated as the average of per capita water use, or 106 GPCD as shown in **Table 5-3**.

Table 5-1. Retail Population for 10-Year and Five-Year Baselines
[SB X7-7 Verification Form Table 3: Service Area Population]

10-Year Baseline	Five-Year Baseline	Year	Service Area Population		
			In-City Retail[a]	Suburban Retail[b]	Total Retail
Year 1	—	2001	780,614	1,634	**782,248**
Year 2	—	2002	782,765	1,633	**784,398**
Year 3	—	2003	782,599	1,630	**784,229**
Year 4	—	2004	781,308	1,626	**782,934**
Year 5	—	2005	780,187	1,619	**781,806**
Year 6	Year 1	2006	781,295	1,611	**782,906**
Year 7	Year 2	2007	787,127	1,786	**788,913**
Year 8	Year 3	2008	795,002	1,773	**796,775**
Year 9	Year 4	2009	800,239	1,751	**801,990**
Year 10	Year 5	2010	805,235	1,747	**806,982**

a In-City population estimated as County of San Francisco population obtained from the California Department of Finance Report E-8: Historical Population and Housing Estimates for Cities, Counties, and the State, 2000-2010, released September 2012. Population data for 2001 through 2009 are for January 1 of the applicable year, whereas population data for 2010 is for April 1, 2010 per the revised 2010 decennial census count.

b Suburban retail population based on estimates for the Town of Sunol, Redwood City, Daly City, Fremont, Millbrae, Castlewood CSA, and San Francisco County Jail #5. Groveland CSD is not included.

1) Population of retail customers in the Town of Sunol was estimated using the DWR Population Tool. Output from the tool is provided in **Appendix J**.
2) Populations of retail customers in Redwood City, Daly City, Fremont, Millbrae, and Castlewood were estimated using data from the 2000 and 2010 U.S. Census at the census block level.
3) Inmate population of the San Francisco County Jail #5 in San Bruno was provided by staff of the San Francisco Sheriff's Department.
4) Other suburban customers include individual research and commercial facilities, such as the Lawrence Livermore National Lab, San Francisco International Airport, National Aeronautics and Space Administration, etc. Because these are non-residential facilities, their population is assumed to be zero.

Table 5-2. Retail Gross Water Use for 10-Year and Five-Year Baselines (mgd)

[SB X7-7 Verification Form Table 4: Annual Gross Water Use]

10-Year Baseline	Five-Year Baseline	Year	Volume Into Distribution System[a]	Deductions					Annual Gross Water Use
				Exported Water	Change in Storage[b]	Indirect Recycled Water	Water Delivered for Agricultural Use	Process Water	
Year 1	—	2001	90.2	0	-0.01	0	0	0	90.2
Year 2	—	2002	90.4	0	0.00	0	0	0	90.4
Year 3	—	2003	87.3	0	0.15	0	0	0	87.3
Year 4	—	2004	84.8	0	0.02	0	0	0	84.8
Year 5	—	2005	84.8	0	-0.09	0	0	0	84.8
Year 6	Year 1	2006	83.6	0	0.00	0	0	0	83.6
Year 7	Year 2	2007	81.7	0	0.03	0	0	0	81.7
Year 8	Year 3	2008	81.5	0	0.00	0	0	0	81.5
Year 9	Year 4	2009	79.2	0	-0.01	0	0	0	79.2
Year 10	Year 5	2010	76.0	0	0.06	0	0	0	76.0
10-Year Baseline Average Gross Water Use									**83.9**
Five-Year Baseline Average Gross Water Use									**80.4**
2015 Compliance Year									**69.6**

a All sources are metered, and all meters are calibrated annually.

b Changes in distribution system storage were estimated based on storage records of all in-City storage. Most suburban retail systems do not have storage facilities or the changes in storage were found to be negligible.

Table 5-3. Retail Per Capita Water Use for 10-Year and Five-Year Baselines

[SB X7-7 Verification Form Table 5: Gallons Per Capita Per Day (GPCD)]

10-Year Baseline	Five-Year Baseline	Year	Service Area Population	Annual Gross Water Use (mgd)	Daily Per Capita Water Use (GPCD)
Year 1	—	2001	782,248	90.2	115
Year 2	—	2002	784,398	90.4	115
Year 3	—	2003	784,229	87.3	111
Year 4	—	2004	782,934	84.8	108
Year 5	—	2005	781,806	84.8	108
Year 6	Year 1	2006	782,906	83.6	107
Year 7	Year 2	2007	788,913	81.7	104
Year 8	Year 3	2008	796,775	81.5	102
Year 9	Year 4	2009	801,990	79.2	99
Year 10	Year 5	2010	806,982	76.0	94
10-Year Baseline Average GPCD					**106**
Five-Year Baseline Average GPCD					**101**
2015 Compliance Year					**82**

5.2 PER CAPITA WATER USE TARGETS

Consistent with its 2010 UWMP, the SFPUC has elected to continue to use Method 3 of the four approved methods provided by the Water Conservation Act of 2009 for determining urban water use targets. The retail service area is contained entirely within the San Francisco Bay hydrologic region. The hydrologic region baseline, interim, and 2020 targets are 157, 144, and 131 GPCD, respectively. To calculate the urban water use targets using Method 3, 95% of the 2015 interim and 2020 targets are calculated, yielding 2015 interim and 2020 targets of 137 and 124 GPCD, respectively.

5.3 CONFIRMATION OF WATER USE TARGET

The base daily per capita water use must be confirmed using a five-year base period to assure that the target meets a minimum threshold. Calculation of daily per capita water use for the five-year period is performed in the same way as for the 10-year period. Consistent with its 2010 UWMP, the SFPUC used the period between 2006 through 2010 as its five-year target confirmation period. As shown in **Table 5-2** and **Table 5-3** respectively, the five-year baseline average gross water use is 80.4 mgd, and the five-year average baseline per capita water use is 101 GPCD.

Subsequently, an urban retail water supplier's 2020 target shall be at least 5% of the five-year baseline per capita water use. The SFPUC's daily per capita water use for the five-year period from 2006 to 2010 is 101 GPCD. Because it is above a 100-GPCD threshold specified by the CWC, the 2020 target must be adjusted to reduce water use by a minimum of 5% of the five-year baseline, or 5 GPCD (101 GPCD multiplied by 5%). As such, the SFPUC's highest allowable 2020 target is 96 GPCD (initial 2020 target of 101 GPCD minus the adjustment of 5 GPCD). Since the highest allowable 2020 target is less than the target calculated using Method 3, the SFPUC's 2020 target is therefore adjusted to 96 GPCD. The resulting 2015 interim target is 101 GPCD (i.e., the midpoint between the 10-year baseline of 106 GPCD and the 2020 target of 96 GPCD) (see **Table 5-4**).

Table 5-4. Baselines and Targets Summary (GPCD)
[Standardized Table 5-1: Baselines and Targets Summary]

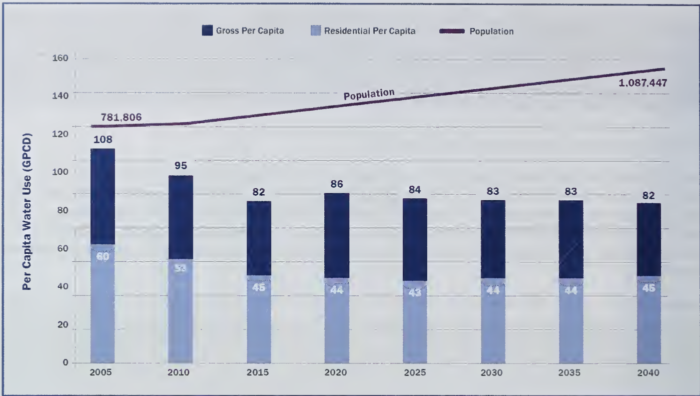
Baseline Period	Start Year	End Year	Average Baseline	Interim 2015 Target	Confirmed 2020 Target
10–Year Baseline	2001	2010	106	101	96
Five-Year Baseline	2006	2010	101	—	—

5.4 COMPLIANCE WITH 2015 WATER USE TARGET

As shown in **Table 5-3**, with a 2015 per capita water use of 82 GPCD, the SFPUC is in compliance with its 2015 interim target of 101 GPCD. No adjustments were needed.

The SFPUC recently completed the Retail Water Conservation Plan, in which an analysis was performed to project its daily per capita water use taking into consideration the impact of population and employment growth, as well as passive and active conservation efforts. The analysis projected that, with its continued water conservation program, the SFPUC's per capita water use in 2020 would be approximately 86 GPCD, indicating that it is also on track of meeting the final 2020 target of 96 GPCD. Furthermore, **Figure 5-1** shows gross and residential per capita water use through 2040 as estimated in the Conservation Plan.

Figure 5-1. Historic and Projected Per Capita Water Use



5.5 ASSISTANCE TO WHOLESALE CUSTOMERS

BAWSCA is the only entity of its kind to have authority to perform regional water supply reliability planning for its member agencies. Among other services, it also has the authority to coordinate water conservation programs and services for its member agencies. BAWSCA manages a Regional Water Conservation Program that is composed of several different conservation measures and is designed to support and augment its member agencies' customer efforts to use water more efficiently. These efforts include the administration of several regional water conservation measures, including measures designed to educate member agency customers about water-efficient landscaping and incentivize irrigated turf removal.

Under the terms of the WSA, the SFPUC cannot provide direct financial assistance for conservation programs to an individual Wholesale Customer and add this expense to the wholesale revenue requirement for that year. The SFPUC can provide staff to assist and, through agreement with BAWSCA, can develop service area-wide conservation programs funded jointly by retail customers and Wholesale Customers. To this end, the SFPUC works closely with BAWSCA as opportunities arise to jointly develop outreach and communications related to the RWS and conservation. For example, the SFPUC and BAWSCA partnered to launch regional campaigns in the summers of 2014 and 2015 to heighten awareness of the drought and encourage conservation. The regional campaigns appeared in the form of billboards and advertisements at transit stations, on television, in newspapers, and in online videos. The SFPUC also provides technical and administrative assistance to the Wholesale Customers on preparing information to the public as requested.

SECTION 6: SYSTEM SUPPLIES

This section describes current and projected water supplies, as well as the various sources of supplies available to meet retail and wholesale water demands. Potential recycled water uses and supply availability are addressed. This section also summarizes the options used, or being considered, by the SFPUC to maximize resources and minimize the need to import water from the RWS watersheds.

As explained in **Section 2.4**, Groveland CSD is accounted for as a retail customer in this section, but as a wholesale customer in the corresponding standardized tables in **Appendix B**.

6.1 RWS SUPPLIES FOR RETAIL AND WHOLESALE CUSTOMERS

The SFPUC serves its retail and wholesale customers through the integrated operation of local Bay Area water production facilities and the Hetch Hetchy System. The local watershed facilities are operated to conserve local runoff for delivery, and to maintain enough stored water to meet demands in the event of an emergency that affects the supply of water from Hetch Hetchy. Demands that are not met by local runoff are met with water diverted from the Tuolumne River through the Hetch Hetchy System. On average, the Hetch Hetchy System provides approximately 85% of the water delivered by the SFPUC. During dry years, the water received from the Hetch Hetchy System can amount to over 90% of the total water delivered.

The amount of water available to the SFPUC is constrained by hydrology, physical facilities, and the institutional parameters that allocate the water supply of the Tuolumne River. Due to these constraints, the SFPUC is very dependent on reservoir storage to maximize the reliability of its water supplies. More importantly, reservoir storage provides water supply carry-over capability. During dry years, a very small share of the Tuolumne River supply is available to the SFPUC and the local watersheds produce very little water. Reservoir storage is critical during drought cycles because it enables the SFPUC to carry-over water supply from wet years to dry years.

6.1.1 Water Rights

The City and County of San Francisco holds both pre-1914 appropriative water rights and post-1914 water rights to store and deliver water from the Tuolumne River and local watersheds. Appropriative water rights allow the holder to divert from a source not connected to its place of use. These rights are based on seniority and the use of water must be reasonable, beneficial, and not wasteful. In 1914, California established a formal water rights permit system (by the 1913 Water Commission Act) administered by the SWRCB. The SWRCB does not have permitting jurisdiction over pre-1914 appropriative water rights.

With the Raker Act of 1913, Congress granted San Francisco rights of way for the construction and operation of Hetch Hetchy facilities, which are predominantly located on federally owned land in Yosemite National Park and Stanislaus National Forest. The Raker Act recognized the senior water rights of Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts) to divert water from the Tuolumne River, and specified conditions for the release of water to the Districts and other conditions imposed by Congress for the protection of recreation in Yosemite and other purposes.

Under the Raker Act Section 9(c) and the subsequent Fourth Agreement between San Francisco and the Districts, the Districts are entitled to the natural flow of the Tuolumne River (2,416 cubic feet per second [cfs] between June 13 and April 15 of each year and 4,066 cfs between April 15 and June 13, the spring snowmelt period). These flows are computed on a daily basis based on unimpaired conditions at La Grange Dam below

Don Pedro. During multiple drought years, the SFPUC's water diversions may be limited to previously stored (carry-over) water in system reservoirs and the water bank account in Don Pedro reservoir.[8]

6.1.2 Water System Improvement Program

The WSIP is a $4.8 billion, multi-year, capital program to upgrade the RWS and is approximately 90% complete to date. The SFPUC undertook the WSIP to ensure the ability of the RWS to meet Level of Service goals for water quality, seismic reliability, delivery reliability, and water supply. The Water Supply LOS goal stated in WSIP is to meet customer water needs in non-drought and drought periods. **Figure 6-1** lists the WSIP projects and their locations. The goals and objectives of the WSIP are presented in **Table 6-1**.

6.1.3 Programmatic Environmental Impact Report and Phased WSIP Variant

As required under CEQA, the San Francisco Planning Department prepared a Programmatic Environmental Impact Report (PEIR) for the WSIP. The PEIR evaluated the potential environmental impacts of the proposed WSIP projects and identified potential mitigations to those impacts. The PEIR also evaluated several alternatives to meet the SFPUC service area's projected increase in water demand through 2030. The water supply improvement options that were investigated included 10 alternatives using various water supply combinations from the local watersheds; the Tuolumne and Lower Tuolumne River; ocean desalination; and additional recycled water, groundwater, and conservation. The PEIR was certified by the San Francisco Planning Commission on October 30, 2008. On the same day, the SFPUC adopted the Phased WSIP Variant option in Resolution No. 08-200.

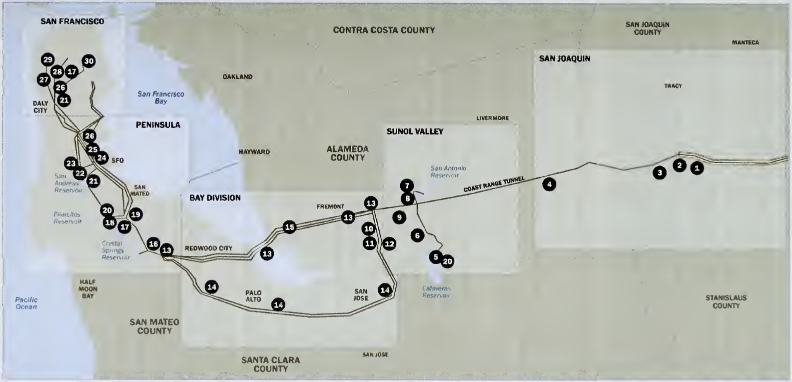
At the request of the SFPUC, the San Francisco Planning Department studied the Phased WSIP Variant as part of the environmental analysis. The SFPUC identified this variant to consider a program scenario that involved full implementation of all proposed WSIP facility improvement projects to achieve public health, seismic safety, and delivery reliability goals as soon as possible, but with phased implementation of a water supply program to meet projected water purchases through 2030. Deferring the 2030 water supply element of the WSIP until 2018 would allow the SFPUC and its Wholesale Customers to focus first on implementing additional local recycled water, groundwater, and demand management actions while minimizing additional diversions from the watersheds.

The Phased WSIP Variant establishes a mid-term planning milestone in 2018 when the SFPUC will reevaluate water demands through 2030 in the context of then-current information, analysis, and available water resources. The SFPUC has historically made annual average deliveries ranging from 285 mgd in 1987 to 265 mgd in 2005 from the RWS. Annual average deliveries in 2005 provided the baseline year for the Phased WSIP. The Phased WSIP Variant would meet the projected 2018 purchase requests of 285 mgd from the RWS by capping purchases at 265 mgd (i.e., the ISL of 265 mgd established in the WSA); the remaining 20 mgd would be met through water efficiencies and conservation, water recycling and local groundwater use: 10 mgd by Wholesale Customers and 10 mgd in the City. By December 31, 2018, the SFPUC will reevaluate water system demands and supply options and conduct additional studies and environmental reviews necessary to address water supply needs after 2018 (further described in **Section 4.2.1.2**). Additionally, in response to the SFPUC's adoption of the Phased WSIP Variant, BAWSCA, on behalf of the Wholesale Customers, began developing a Long-Term Reliable Water Supply Strategy to identify appropriate water management actions to increase the long-term water supply reliability of its member agencies and their customers under normal and drought conditions through 2040. The Strategy is further described in **Section 7.4.1**.

---

[8] Turlock and Modesto Irrigation Districts have senior water rights to the SFPUC for the Tuolumne River water and are entitled to the first increment of flow in the basin. Water bank provides a credit and debit system which allows the SFPUC to divert water upstream while meeting its obligations to Modesto and Turlock Irrigation Districts. Through this mechanism the SFPUC may pre-deliver the Districts entitlements and credit the water bank so that at other times the SFPUC may retain water upstream while the Districts debit water bank.

Figure 6-1. Water System Improvement Program



1 San Joaquin Pipeline System
2 Rehabilitation of Existing San Joaquin Pipelines
3 Tesla Treatment Facility
4 Lawrence Livermore Water Quality Improvement
5 Calaveras Dam Replacement
5 Calaveras Reservoir Upgrades
5 San Antonio Backup Pipeline
6 SVWTP Expansion & Treated Water Reservoir
7 Alameda Creek Recapture Project
8 Alameda Siphon #4
8 San Antonio Pump Station Upgrade
9 New Irvington Tunnel
10 BDPL No 4 Condition Assessment PCCP Sections
11 Seismic Upgrade of BDPL Nos 3 &4
12 BDPL Nos 3 & 4 Crossover/Isolation Valves
13 BDPL Reliability Upgrade Tunnel
13 BDPL Reliability Upgrade Pipeline
13 BDPL Reliability Upgrade - Relocation of BDPL Nos. 1 & 2
14 BDPL Nos 3 &4 Crossovers
15 SFPUC/EBMUD Intertie
16 Pulgas Balancing - Inlet/Outlet Work
16 Pulgas Balancing - Discharge Channel Modifications
16 Pulgas Balancing - Structural Rehabilitation & Roof Replacement
16 Pulgas Balancing - Modifications of Existing Dechlorination Facility
17 Crystal Springs Pipeline No. 2 Replacement
18 Lower Crystal Springs Pipeline No. 2 Replacement
19 New Crystal Springs Bypass Tunnel
20 Adit Leak Repair - Crystal Springs/Calaveras
21 Crystal Springs/San Andreas Transmission Upgrade
22 HTWTP Long-Term Improvements
23 HTWTP Short-Term Improvements Coagulation & Flocculation/Remaining Filters
24 Capuchino Valve Lot Improvement
25 Peninsula Pipelines Seismic Upgrade
26 Baden and San Pedro Valve Lots Improvements
27 Regional Groundwater Storage & Recovery
28 San Andreas Pipeline No. 3 Installation
29 Sunset Reservoir - North Basin
30 University Mound Reservoir - North Basin

WSIP Projects in Various Locations

Standby Power Facilities Various Locations
Pipeline Repair & Readiness Improvements
SCADA System - Phase II
System Security Upgrades
Peninsula Pipelines Security Upgrade
Cross Connection Controls
Programmatic EIR
Watershed Environment Improvement Program
Bioregional Habitat Restoration
Vegetation Restoration of WSIP Construction Sites
Long Term Mitigation Endowment

Table 6-1. Water System Improvement Program Goals and Objectives

[Standardized Table Not Applicable]

Program Goal	System Performance Objective
Water Quality: maintain high water quality	• Design improvements to meet current and foreseeable future federal and state water quality requirements. • Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filtered water from local watersheds. • Continue to implement watershed protection measures.
Seismic Reliability: reduce vulnerability to earthquakes	• Design improvements to meet current seismic standards. • Deliver basic service to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for design of the regional system is 229 mgd. The performance objective is to provide delivery to at least 70% of the turnouts in each region, with 104, 44, and 81 mgd delivered to the East/South Bay, Peninsula, and San Francisco, respectively. • Restore facilities to meet average-day demand of up to 300 mgd within 30 days after a major earthquake.
Delivery Reliability: increase delivery reliability and improve ability to maintain the system	• Provide operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service. • Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages. • Provide operational flexibility and system capacity to replenish local reservoirs as needed. • Meet the estimated average annual demand of 300 mgd under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage due to a natural disaster, emergency, or facility failure/upset.
Water Supply: meet customer water needs in non-drought and drought periods	• Meet average annual demand of 265 mgd from the SFPUC watersheds for retail and Wholesale Customers during non-drought years for system demands through 2018. • Meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20% system-wide reduction in water service during extended droughts. • Diversify water supply options during non-drought and drought periods. • Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers.
Sustainability: enhance sustainability in all system activities	• Manage natural resources and physical systems to protect watershed ecosystems. • Meet, at a minimum, all current and anticipated legal requirements for protection of fish and wildlife habitat. • Manage natural resources and physical systems to protect public health and safety.
Cost-effectiveness: achieve a cost-effective, fully operational system	• Ensure cost-effective use of funds. • Maintain gravity-driven system. • Implement regular inspection and maintenance program for all facilities.

The Phased WSIP Variant includes the following water supply elements:

- Water supply delivery to RWS customers through 2018 only of 265 mgd average annual target delivery. This includes 184 mgd for the Wholesale Customers and 81 mgd for retail customers.[9]

- Water supply sources include 265 mgd average annual from the RWS and 20 mgd of water conservation[10], recycled water and local groundwater developed within the SFPUC's service area (10 mgd in the retail service area and 10 mgd in the wholesale service area);

- Water supply projects to meet dry-year demands with no greater than 20% system-wide rationing in any one year:
    - Restoration of Calaveras Reservoir capacity;
    - Restoration of Crystal Springs Reservoir capacity;
    - Westside Basin Groundwater Conjunctive Use;
    - Water Transfer with MID/TID;

- Reevaluation of 2030 demand projections, potential RWS purchase requests, and water supply options by December 31, 2018 and a separate SFPUC decision no later than 2018 regarding RWS future water deliveries after 2018.

Dry year water supply projects are detailed in **Section 7.2**.

6.1.4 Future Regional Supplies

In addition to the supply projects discussed above, the SFPUC is exploring a range of additional options to improve water supply reliability in future years for the purposes of managing the water supply loss associated with instream flow release requirements and possibly to meet the long-term demands of the Cities of San Jose and Santa Clara. In adopting the Calaveras Dam Replacement Project and the Lower Crystal Springs Dam Improvements Project, the SFPUC committed to providing instream flow releases (a.k.a., fishery flows) below Calaveras Dam and Lower Crystal Springs Dam, as well as bypass flows around Alameda Creek Diversion Dam. The fishery flow schedules for Alameda Creek and San Mateo Creek represent a potential decrease in available average annual water supply of 9.3 mgd and 3.5 mgd, respectively, for a total of 12.8 mgd average annually. The Alameda Creek Recapture Project[11] is proposed to replace the 9.3 mgd of supply lost to Alameda Creek fishery flows. The Draft EIR for this project is scheduled to be published in the fall of 2016. If this is implemented, 3.5 mgd of instream flow releases into San Mateo Creek will create a shortfall in meeting the target delivery of 265 mgd and slightly increase dry-year water supply needs. **Section 7.3** describes this shortfall in more detail.

The SFPUC is committed to meeting its contractual obligation to its Wholesale Customers of 184 mgd and its delivery reliability goal of 265 mgd with no greater than 20% rationing in any one year of a drought. Through the WaterMAP, which is further described in **Section 7.7.1**, the SFPUC addresses the 3.5 mgd shortfall and how to meet new demands that may occur should San Jose and Santa Clara become permanent customers.

---

[9] As explained in **Section 2.4**, Groveland CSD is considered a retail customer of the SFPUC. Thus, RWS supplies to Groveland CSD are accounted for in the retail supply allocation of 81 mgd.
[10] Water conservation is accounted for as a demand reduction.
[11] The project formerly known as the Upper Alameda Creek Filter Gallery Project in the WSIP was later reconfigured as the Alameda Creek Recapture Project

6.1.5 Water Quality of RWS Supplies

As described in **Section 3.1**, the RWS delivers high-quality water. The current surface water supplies available to the RWS include the Tuolumne River and supplies from local Bay Area reservoirs. The majority of the water supply originates in the upper Tuolumne River watershed high in the Sierra Nevada, remote from human development and pollution. This high-quality Hetch Hetchy water is protected in pipes and tunnels as it is conveyed to the Bay Area, requiring only primary disinfection and pH adjustment to control corrosion in the pipelines. In addition, Hetch Hetchy water undergoes UV disinfection at the Tesla Treatment Facility, further ensuring high water quality.

The USEPA and SWRCB DDW have approved the use of this drinking water source without requiring filtration at a treatment plant. However, local water from the local watersheds requires filtration to meet drinking water quality requirements. The filtered and treated water from the local watersheds is blended with Hetch Hetchy water, and most customers receive this blended water supply. System water quality, including both raw water and treated water, is continuously monitored and tested to assure that water delivered to customers meets or exceeds federal and State drinking water and public health requirements.

The SFPUC will continue to rely on these high-quality water sources. No degradation of water quality is anticipated in the future.

An annual water quality report (i.e., Consumer Confidence Report) is prepared by the SFPUC for its customers each spring and is available at www.sfwater.org/qualitymatters.

6.1.6 Climate Change Impacts to RWS Supplies

The issue of climate change has become an important factor in water resources planning in the State, and is frequently being considered in urban water management planning, although the extent and precise effects of climate change remain uncertain. There is convincing evidence that increasing concentrations of greenhouse gases have caused and will continue to cause a rise in temperatures around the world, which will result in a wide range of changes in climate patterns. Moreover, observational data shows that a warming trend occurred during the latter part of the 20th century and will likely continue through the 21st century. These changes will have a direct effect on water resources in California, and numerous studies have been conducted to determine the potential impacts to water resources. Based on these studies, climate change could result in the following types of water resource impacts, some of which are likely to affect the Tuolumne River watershed and local watersheds in the Bay Area:

- Reductions in the average Sierra Nevada annual snowpack due to a rise in the snowline elevation and a shallower snowpack at lower elevations, and a shift in snowmelt runoff to earlier in the year;
- Changes in the timing, intensity and variability of precipitation, and an increased amount of precipitation falling as rain instead of as snow;
- Long-term changes in watershed vegetation and increased incidence of wildfires that could affect water quality;
- Sea level rise and an increase in saltwater intrusion;
- Increased water temperatures with accompanying potential adverse effects on some fisheries and water quality;

- Increases in evaporation and concomitant increased irrigation need; and
- Changes in urban and agricultural water demand.

Both the SFPUC and BAWSCA participated in the 2013 update of the Bay Area Integrated Regional Water Management Plan (BAIRWMP), which includes an assessment of the potential climate change vulnerabilities of the region's water resources and identifies climate change adaptation strategies. In addition, the SFPUC has studied and continues to study the effects of climate change on the RWS. These works are summarized below.

6.1.6.1 Bay Area Integrated Regional Water Management Plan

Climate change adaptation was established as an overarching theme for the 2013 BAIRWMP update. As stated in the BAIRWMP, identification of watershed characteristics that could potentially be vulnerable to future climate change is the first step in assessing vulnerabilities of water resources in the Bay Area Region (Region). Vulnerability is defined as the degree to which a system is exposed to, susceptible to, and able to cope with or adjust to, the adverse effects of climate change. A vulnerability assessment was conducted in accordance with the DWR's *Climate Change Handbook for Regional Water Planning* and using the most current science available for the Region. The vulnerability assessment, summarized in **Table 6-2**, provides the main water planning categories applicable to the Region and a general overview of the qualitative assessment of each category with respect to anticipated climate change impacts.

6.1.6.2 SFPUC Climate Change Studies

The SFPUC views assessment of the effects of climate change as an ongoing project requiring regular updating to reflect improvements in climate science, atmospheric/ocean modeling, and human response to the threat of greenhouse gas emissions. Climate change research by the SFPUC began in 2009 and continues to be refined. In its 2012 report "Sensitivity of Upper Tuolumne River Flow to Climate Change Scenarios," the SFPUC assessed the sensitivity of runoff into Hetch Hetchy Reservoir to a range of changes in temperature and precipitation due to climate change. Key conclusions from the report include the following:

- With differing increases in temperature alone, the median annual runoff at Hetch Hetchy would decrease by 0.7-2.1% from present-day conditions by 2040 and by 2.6-10.2% from present-day by 2100. Adding differing decreases in precipitation on top of temperature increases, the median annual runoff at Hetch Hetchy would decrease by 7.6-8.6% from present-day conditions by 2040 and by 24.7-29.4% from present-day conditions by 2100.
- In critically dry years, these reductions in annual runoff at Hetch Hetchy would be significantly greater, with runoff decreasing up to 46.5% from present day conditions by 2100 utilizing the same climate change scenarios.
- In addition to the total change in runoff, there will be a shift in the annual distribution of runoff. Winter and early spring runoff would increase and late spring and summer runoff would decrease.
- Under all scenarios, snow accumulation would be reduced and snow would melt earlier in the spring, with significant reductions in maximum peak snow water equivalent under most scenarios.

Currently, the SFPUC is planning to conduct a comprehensive assessment of the potential effects of climate change on water supply. The assessment will incorporate an investigation of new research on the current drought and is anticipated to be completed in the next few years.

Table 6-2. Summary of BAIRWMP Climate Change Vulnerability Assessment

[Standardized Table Not Applicable]

Vulnerability Areas	General Overview of Vulnerabilities
Water Demand	**Urban and Agricultural Water Demand** – Changes to hydrology in the Region as a result of climate change could lead to changes in total water demand and use patterns. Increased irrigation (outdoor landscape or agricultural) as a result of temperature rise, increased evaporative losses due to warmer temperature, and a longer growing season are also expected. Water treatment and distribution systems are most vulnerable to increases in maximum day demand.
Water Supply	**Imported Water** – Imported water derived from the Sierra Nevada sources and Delta diversions provide 66% of the water resources available to the Region. Potential impacts on the availability of these sources resulting from climate change directly affect the amount of imported water supply delivered to the Region. **Regional Surface Water –** Although future projections suggest that changes in total annual precipitation over the Region may not occur, there may be changes to when precipitation occurs, with reductions in the spring and more intense rainfall in the winter. **Regional Groundwater** – Changes in local hydrology could affect natural recharge to the local groundwater aquifers and the quantity of groundwater that could be pumped sustainably over the long-term in some areas. Decreased inflow from more flashy or more intense runoff, increased evaporative losses and warmer and shorter winter seasons can alter natural recharge of groundwater. Salinity intrusion into coastal groundwater aquifers due to sea-level rise could interfere with local groundwater uses. Furthermore, additional reductions in imported water supplies would lead to less imported water available for managed recharge of local groundwater basins and potentially more groundwater pumping in lieu of imported water availability.
Water Quality	**Imported Water –** For sources derived from the Delta, sea-level rise could result in increases in chloride and bromide (a disinfection by-product (DBP) precursor that is also a component of sea water), potentially requiring changes in treatment for drinking water. Increased temperature could result in an increase in algal blooms, taste and odor events, and a general increase in DBP formation. **Regional Surface Water –** Increased temperature could result in lower dissolved oxygen in streams, and prolong thermocline stratification in lakes and reservoirs forming anoxic bottom conditions and algal blooms. Decrease in annual precipitation could result in higher concentrations of contaminants in streams during droughts or in association with flushing rain events. Increased wildfire risk and flashier or more intense storms could increase turbidity loads for water treatment. **Regional Groundwater** – Sea-level rise could result in increases in chlorides and bromide for some coastal groundwater basins in the Region. Water quality changes in imported water used for recharge could also impact groundwater quality.

Table 6-2 (continued)

Vulnerability Areas	General Overview of Vulnerabilities
Sea-Level Rise	Sea-level rise is additive to tidal range, storm surges, stream flows, and wind waves, which together will increase the potential for higher total water levels, overtopping, and erosion. Much of the bay shoreline is comprised of low-lying diked baylands which are already vulnerable to flooding. In addition to rising mean sea level, continued subsidence due to tectonic activity will increase the rate of relative sea-level rise. As sea-level rise increases, the consequences of coastal storm events and the cost of damage to the built and natural environment will increase. Existing coastal armoring (including levees, breakwaters, and other structures) is likely to be insufficient to protect against projected sea-level rise. Crest elevations of structures will have to be raised or structures relocated to reduce hazards from higher total water levels and larger waves.
Flooding	Climate change projections are not sensitive enough to assess localized flooding, but the general expectation is that more intense storms would occur thereby leading to more frequent, longer and deeper flooding. Changes to precipitation regimes may increase flooding. Elevated Bay elevations due to sea-level rise will increase backwater effects exacerbating the effect of fluvial floods and storm drain backwater flooding.
Ecosystem and Habitat	Changes in the seasonal patterns of temperature, precipitation, and fire due to climate change can dramatically alter ecosystems that provide habitats for California's native species. These impacts can result in species loss, increased invasive species ranges, loss of ecosystem functions, and changes in vegetation growing ranges. Reduced rain and changes in the seasonal distribution of rainfall may alter timing of low flows in streams and rivers, which in turn would have consequences for aquatic ecosystems. Changes in rainfall patterns and air temperature may affect water temperatures, potentially affecting coldwater aquatic species. Bay Area ecosystems and habitat provide important ecosystem services, such as: carbon storage, enhanced water supply and quality, flood protection, food and fiber production. Climate change is expected to substantially change several of these services. The region provides substantial aquatic and habitat-related recreational opportunities, including: fishing, wildlife viewing, and wine industry tourism (a significant asset to the region) that may be at risk due to climate change effects.
Hydropower	Currently, several agencies in the Region produce or rely on hydropower produced outside of the Region for a portion of their power needs. As the hydropower is produced in the Sierra, there may be changes in the future in the timing and amount of energy produced due to changes in the timing and amount of runoff as a result of climate change. Some hydropower is also produced within the region and could also be affected by changes in the timing and amount of runoff.
Source: Adapted from 2013 Bay Area Integrated Regional Water Management Plan (BAIRWMP), Table 16-3.	

6.1.7 Summary of Existing and Future RWS Supplies

As discussed earlier, deliveries from the RWS are limited to an average annual of 265 mgd through 2018. As a decision on future water deliveries beyond 2018 has not yet been made, this 2015 UWMP assumes that the 265 mgd delivery extends to 2040. Although up to 81 mgd of RWS supplies are available in normal years, the SFPUC is committed to developing local supplies to meet retail demands. Therefore, the SFPUC would use local groundwater, recycled water, and non-potable water supplies before using RWS supplies to meet retail demands. Current and projected supplies from the RWS for both retail and wholesale customers are shown in **Table 6-3**.

Table 6-3. Regional Water System Supplies in Normal Years (mgd)

[Standardized Table 6-9 Retail: Water Supplies – Projected]
[Standardized Table 6-9 Wholesale: Water Supplies – Projected]

	Actual	Projected				
RWS Supply by Customer	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Retail Customers[a, b]	67.7	70.5	71.9	73.2	76.7	80.6
Wholesale Customers[c, d]	184.0	184.0	184.0	184.0	184.0	184.0
Total RWS Supplies	**265.0**	**265.0**	**265.0**	**265.0**	**265.0**	**265.0**

a Assuming that the retail supply allocation of 81 mgd per the WSA is extended to 2040, up to 81 mgd of RWS supply may be used.

b Groveland CSD is reported as a wholesale customer for the purposes of this 2015 UWMP, but is considered a retail customer of the SFPUC solely for purposes of allocating RWS supplies between retail customers and Wholesale Customers. Its demands would be met by the retail supply allocation of 81 mgd.

c Projected Wholesale Customer deliveries are limited to 184 mgd. Prior to 2018, 184 mgd includes the demands of the Cities of San Jose and Santa Clara. After 2018, San Jose and Santa Clara will be supplied on a temporary and interruptible basis, with their total supply not exceeding 9 mgd assuming supply is available (decision to be made by end of 2018).

d Cordilleras MWC is not subject to the WSA, nor to the wholesale supply allocation of 184 mgd. The demands of Cordilleras MWC are minor (projected to be less than 0.01 mgd) and are anticipated to be met with RWS supplies through 2040.

6.2 LOCAL SUPPLIES FOR RETAIL CUSTOMERS

The RWS comprises about 97% of total retail water supplies, while the remaining portion is from locally-produced groundwater, recycled water, and non-potable water. These local supplies are described in the following sections.

6.2.1 Existing Local Supplies

Existing supplies of groundwater, recycled water, and non-potable water are described below. Future supplies are described in **Section 6.2.2**.

6.2.1.1 Local Groundwater

San Francisco overlies all or part of seven un-adjudicated groundwater basins. These groundwater basins include the Westside, Lobos, Marina, Downtown, Islais Valley, South, and Visitation Valley basins. The Lobos, Marina, Downtown, and South basins are located wholly within City limits, while the remaining three extend south into San Mateo County. The portion of the Westside Basin aquifer located within the City is referred to as the North Westside Groundwater Basin (or North Westside Basin). With the exception of the Westside and Lobos basins, all of the basins are generally inadequate to supply groundwater for municipal supply due to low yield, contamination, or potential subsidence concerns.

Early in its history, the City made use of local groundwater, springs, and spring-fed surface water ranging from approximately 6.0 to 8.5 mgd prior to 1934. After imports of water from the Hetch Hetchy Reservoir began in October 1934, municipal supplies began to rely almost exclusively on surface water from the RWS.

Local groundwater use, however, has continued in the City. In addition, groundwater has been used and continues to be used in the suburban retail service area. These local groundwater basins are described below.

Westside Groundwater Basin. With an area of about 45 square miles, the Westside Groundwater Basin is the largest groundwater basin in San Francisco and is currently used to meet retail water demands for some irrigation customers. The Westside Groundwater Basin is separated from the Lobos Basin to the north by a northwest-trending bedrock ridge through the northeastern part of Golden Gate Park. San Bruno Mountain and San Francisco Bay form the eastern boundary, and the San Andreas Fault and Pacific Ocean form the western boundary. The southern limit of the Westside Groundwater Basin is defined by an area of high bedrock that separates it from the San Mateo Plain Groundwater Basin. The basin opens to the Pacific Ocean on the northwest and San Francisco Bay on the southeast. Portions of the Westside Groundwater Basin, primarily starting at Lake Merced in the north and going south, contain three aquifers known as the Shallow Aquifer, Primary Production Aquifer, and Deep Aquifer. The Shallow and Primary Production Aquifers also occur north of Lake Merced depending on the presence or absence of subsurface clay layers. The basin has not been adjudicated nor has it been identified by DWR as overdrafted, or as projected to be overdrafted in the future.

The Westside Groundwater Basin is subdivided for management purposes into northern and southern portions by the county line separating San Francisco and San Mateo counties. The county-line boundary between the North and South Westside Groundwater Basins does not have hydrogeological significance other than influencing the jurisdictional distribution of groundwater pumping. No geologic features restrict groundwater flow between the northern and southern parts of the groundwater basin.

Within San Mateo County, the South Westside Groundwater Basin (or South Westside Basin) encompasses 30 miles and extends southeast across the San Francisco Peninsula south of San Bruno Mountain from the ocean near Daly City to San Francisco Bay in Burlingame. It is described in the South Westside Basin Groundwater Management Plan.[12] Municipal water demand within the South Westside Basin is served by the City of San Bruno, California Water Service Company, City of Daly City, and SFPUC as a wholesaler to those entities.

The North Westside Basin has a land surface area of slightly more than 14 square miles encompassing much of the western third of the City, including Lake Merced and most of Golden Gate Park. The North Westside Basin is about 75% residential and commercial, including the Sunset and Parkside districts; and at least 25% park and open space, most notably Golden Gate Park, Lake Merced, golf clubs, and hilltop parks along the basin's eastern boundary. The North Westside Basin land surface extends from sea level along Ocean Beach to nearly 1,000 feet above sea level along a bedrock ridge three to four miles inland. The North Westside Basin is bounded on the north by a mostly buried bedrock ridge extending from Point Lobos southeast through Golden Gate Park and northeast through Lone Mountain. The basin boundary encompasses the panhandle of Golden Gate Park, then extends south-southwest through Twin Peaks and Mount Davidson, crossing south into San Mateo County a little more than a mile east of Lake Merced. The San Andreas Fault Zone trends offshore to the northwest of Daly City and is interpreted to bound the basin on the west. Existing retail groundwater sources are pumped from the North Westside Basin.

The SFPUC has implemented a groundwater monitoring program to evaluate groundwater elevations and quality, along with water elevations at Lake Merced. The monitoring system includes a single well or clusters of two or

[12] City of San Bruno, California Water Service Company, Daly City, and Hetch Hetchy Regional Water System. 2012. *South Westside Basin Groundwater Management Plan.*

more wells at 19 locations. Groundwater levels in each well are monitored continuously using pressure transducers or are measured quarterly by hand. Based on regular groundwater monitoring conducted in the North Westside Basin since 2004, groundwater levels along the Pacific Coast and north of Lake Merced have generally remained above sea level in the Shallow and Primary Production Aquifers.

The SFPUC samples groundwater at five monitoring well locations semiannually to monitor general water quality in the groundwater basin, including four locations near Lake Merced and one at the West Sunset Playground. Three of the locations near Lake Merced include both a Shallow Aquifer and Primary Production Aquifer monitoring well. The monitored parameters include total alkalinity, calcium, magnesium, sodium, potassium, bicarbonate, hardness, chloride, nitrate, sulfate, TDS, pH, and specific conductance. In addition, some wells have been monitored for iron and manganese.

Since 1926, groundwater has been pumped from wells located in Golden Gate Park and the San Francisco Zoo. Based on flow meter data, about 1.5 mgd is produced by these wells. The groundwater is mostly used by the San Francisco Recreation and Park Department for irrigation and other non-potable uses (e.g., lake filling, water exhibits) at Golden Gate Park, the San Francisco Zoo, and landscaped medians along the Great Highway.

There are currently no adopted groundwater management plans for any of the groundwater basins in the City. However, in March 2015, SFPUC was established as the Groundwater Sustainability Agency for the seven groundwater basins in San Francisco. In addition, the SFPUC is currently preparing a Groundwater Sustainability Plan for the North Westside Basin in compliance with the California Sustainable Groundwater Management Act of 2014. The overall goal of the Groundwater Sustainability Plan for the North Westside Basin will be to assure a long-term, high quality, local water supply for current and future uses.

Livermore Valley Basin, Central Groundwater Sub Basin. In the suburban retail service area, about 0.4 mgd of groundwater is delivered to the Castlewood CSA from the Castlewood Well System operated by the SFPUC (this system is described in **Section 3.1.5.2**). Groundwater is drawn from the Central Groundwater Sub Basin in the Livermore Valley Basin. DWR has not identified this basin as overdrafted, nor as projected to be overdrafted in the future. These wells are metered and have been in operation for several decades. The system serving Castlewood is not connected to the RWS.

Sunol Filter Gallery Subsurface Diversions. The Sunol Filter Gallery (Gallery) is located adjacent to Alameda Creek in Sunol, south of the SFPUC's Sunol Pump Station. The Gallery is approximately 2,000 feet long and consists of a concrete box structure 10 feet 8 inches in height and 6 feet wide. The sides of the box structure are perforated by pipes to allow infiltration of the underflow of Alameda Creek. A 30-inch perforated pipe section in the bed of Alameda Creek also feeds the Gallery, which discharges into the Sunol Aqueduct at the Sunol Water Temple. About 0.3 mgd of groundwater[13] is available from the Gallery, which was used to irrigate the Sunol Valley Golf Club through January 2016. This supply remains available for future potable and irrigation uses.

The volume of groundwater pumped during 2011 to 2015 from the three sources described above are shown in **Table 6-4**.

[13] Although termed groundwater in this section, Gallery supplies are considered to be groundwater under the influence of surface water subject to surface water permitting and water right requirements.

Table 6-4. Groundwater Pumped (mgd)

[Standardized Table 6-1 Retail: Groundwater Volume Pumped]

Groundwater Source	2011	2012	2013	2014	2015
Westside Groundwater Basin[a]	1.3	1.2	1.5	1.5	1.5
Livermore Valley Basin, Central Groundwater Sub Basin[b]	0.4	0.4	0.3	0.4	0.3
Sunol Filter Gallery Subsurface Diversions[c]	0.3	0.4	0.4	0.4	0.4

a Data are obtained from the 2014 Annual Groundwater Monitoring Report, Westside Basin (SFPUC, April 2015). Pumping volumes are reported on a calendar year basis, but are used to approximate fiscal year data for this table. Data for 2015 were not available as of the publication of this document, so data for calendar year 2014 is applied to 2015.

b This basin is the source of water for the Castlewood Well System. Pumping volumes are assumed to be equivalent to billed consumption for Castlewood CSA; obtained from customer billing data.

c Pumping volumes are assumed to be equivalent to billed consumption for Sunol Valley Golf Course; obtained from customer billing data

6.2.1.2 Local Recycled Water

From 1932 to 1981, the City's McQueen Treatment Plant provided recycled water to Golden Gate Park for irrigation and flow augmentation of its streams and lakes. Due to changes in State regulations, the plant could no longer meet required standards. Subsequently, the City closed the McQueen Treatment Plant and discontinued use of recycled water in Golden Gate Park, however, a limited volume of recycled water is currently used in the retail service area as described below.

Southeast Water Pollution Control Plant. Disinfected secondary-treated recycled water from the Southeast WPCP is used on a limited basis for wash-down operations at the plant. Recycled water is also provided to construction contractors, City departments, and other interested parties for use within the City via the truck-fill station. Permitted uses include soil compaction, dust control, landscape irrigation, street cleaning, and sewer flushing. In 2015, over 739,000 gallons (about 0.002 mgd) were distributed from the truck-fill station for these uses. However, this volume of recycled water use does not materially contribute to overall retail demands.

Harding Park. The Harding Park Recycled Water Project, a partnership between the SFPUC and NSMCSD, was completed in October 2012 and provides tertiary-treated recycled water for irrigating the Harding Park and Fleming Golf Courses in San Francisco. In 2015, 0.24 mgd of recycled water was delivered to Harding Park, a retail customer of the SFPUC.

Sharp Park. The Pacifica Recycled Water Project provides recycled water to several irrigation customers in Pacifica including the Sharp Park Golf Course, a retail customer of the SFPUC. This project was developed and constructed through a partnership between the SFPUC and NCCWD. A new automated irrigation system was installed on the east side of the golf course, and recycled water delivery began in October 2014. In 2015, recycled water deliveries were estimated to be 5 MG (about 0.01 mgd). The remainder of the golf course is currently supplied with potable water. When completed, recycled water deliveries to Sharp Park will be approximately 30 MG per year (about 0.1 mgd).

Projections of recycled water use in the retail service area were provided in the 2010 UWMP. At that time, it was estimated that 0.3 mgd of recycled water would be used in 2015. Actual use in 2015 was approximately 0.3 mgd. A comparison of projected and actual recycled water uses is shown in **Table 6-5**.

Table 6-5. Projected and Actual Recycled Water Use for 2015 (mgd)

[Standardized Table 6-5 Retail: 2010 UWMP Recycled Water Use Projection Compared to 2015 Actual]

Use Type	2010 Projection for 2015	Actual Use in 2015
Irrigation[a]	0.3	0.3
Lake Fill[b]	0	0
Commercial/Industrial	0	0

a Irrigation includes both golf course and other landscape irrigation.

b Lake fill includes wildlife habitat enhancement, wetland recharge, and groundwater recharge.

6.2.1.3 Wastewater Assessment

The SFPUC operates the City's wastewater collection, treatment, and disposal system, which consists of a combined sewer system (which collects both sewage and storm water), three water pollution control plants, and outfalls to San Francisco Bay and the Pacific Ocean. The collection and conveyance system consists of approximately 900 miles of various sizes of underground sewer pipes, transport/storage structures, and pump stations located throughout the City. Two of the City's water pollution control plants, the Southeast WPCP and Oceanside WPCP, provide secondary treatment and operate year-round; while the third plant, the North Point Wet Weather Facility, operates only during wet weather and provides primary treatment. Ultimate disposal of treated wastewater effluent is currently through outfalls to both San Francisco Bay and the Pacific Ocean. **Table 6-6** summarizes the current volumes of wastewater collected, treated, discharged, and recycled within the retail service area.

As mentioned previously, suburban retail water use in 2015 was 4.2 mgd, which was about 6% of total retail demand. As such, the volume of wastewater generated within the SFPUC's water retail service area is assumed to be small compared to in-City wastewater generation. However, notable large suburban retail customers are included in **Table 6-6**.

Table 6-6. Wastewater Operations within Retail Service Area

[Standardized Table 6-2 Retail: Wastewater Collected Within Service Area]

[Standardized Table 6-3 Retail: Wastewater Treatment and Discharge Within Service Area in 2015]

Treatment Plant	Operator	Location	Volume of Wastewater in 2015 (mgd)				Recycled Water Delivered within Retail Service Area in 2015 (mgd)
			Collected	Treated (Level)	Discharged	Recycled	
Southeast WPCP[a]	SFPUC	San Francisco	60.8	60.8 (secondary, undisinfected)	51.0[b]	0[c]	0[c]
Oceanside WPCP	SFPUC	San Francisco	12.9	14,420 (secondary, undisinfected)	13.4[d]	Not recycled	Not recycled
Mel Leong Treatment Plant[e, f]	City and County of San Francisco	San Francisco International Airport	0.6	0.6 (secondary, disinfected-23)	0.6	Up to 0.7	Up to 0.7

a The Southeast Water Pollution Control Plant (WPCP) and North Point Wet Weather Facility are grouped together as one facility because they are hydraulically connected (both plants receive influent from the same collection system) and their discharges are covered by the same permit.

b The volume discharged is less than the volume collected because a small volume of the discharged wastewater is treated to secondary disinfected-23 level and used for other purposes, such as the recycled water truck-fill station.

c About 739,000 gallons (0.002 mgd) of recycled water treated to a secondary, disinfected-23 level were dispensed from the truck-fill station in 2015. However, this volume is not considered large enough to be reported in the 2015 UWMP.

d The volume discharged is higher than the volume collected because the discharged volume includes additional plant recycle streams.

e The Mel Leong Treatment Plant is the only wastewater facility that treats and discharges wastewater generated by a suburban retail water customer within the suburban retail service area. Wastewater utilities serving other suburban retail customers do not treat or dispose of wastewater within the suburban retail service area.

f Volumetric data for Mel Leong Treatment Plant are obtained from its NPDES permit, which provides estimates of volumes in 2011. Per the permit, up to 0.72 mgd can be diverted to an onsite recycled water facility, which provides tertiary-treated recycled water for irrigation and other non-potable uses at SFO.

6.2.2 Future Local Supplies

The SFPUC anticipates that the existing supplies described above will be available in the future. However, to reliably and sustainably meet the future water needs of its retail customers, the SFPUC is supplementing and diversifying its water supply portfolio through the development of local water supplies, such as increasing groundwater, recycled water, and non-potable water production. Projects related to these efforts are described below, and projected volumes are later provided in **Table 6-7**. For water supply projects specific to dry years, see **Section 7.2**.

6.2.2.1 San Francisco Groundwater Supply Project

The San Francisco Groundwater Supply Project involves the construction of six deep well pumping stations to extract up to 4 mgd of water from the Westside Groundwater Basin, as well as over five miles of pipelines to distribute the groundwater to in-City reservoirs for blending with the municipal drinking water supply. The groundwater will be disinfected and blended with RWS supplies before entering the in-City distribution system. Two of the six wells will also serve as emergency drinking water supplies following an earthquake or other natural disaster, and will include a distribution system to fill emergency water tankers.

Construction of the first phase of the project (four wells and pipelines) began in August 2014 and is expected to be completed in early 2017. Construction of the second phase of the project (two wells and pipelines) is expected to begin in late 2016 and coincide with the Westside Recycled Water Project, which is described in the next section.

Although this project would yield a total of 4 mgd, 1.2 mgd is existing supply that is currently being used for irrigation as described in **Section 6.2.1.1**. With the Westside Recycled Water Project, this irrigation demand will be met with recycled water instead, thereby freeing up 1.2 mgd of groundwater for potable use. Thus, 2.8 mgd of net new supply will be generated by this project.

6.2.2.2 Westside Recycled Water Project

As described earlier, two recycled water projects were completed and began deliveries in the last five years: the Harding Park and the Pacifica Recycled Water Projects. A third project, the Westside Recycled Water Project, will include construction of a tertiary recycled water plant and associated pipelines to replace RWS and groundwater supplies currently used to irrigate Golden Gate Park, Lincoln Park and Golf Course, the Presidio Golf Course, as well as other landscaping in the Presidio. The plant will be constructed on the west side of the City at the Oceanside WPCP. For planning purposes, this project is estimated to produce and deliver an annual average of 1.6 mgd (about 0.24 mgd, or 15%, of which will be used for golf course irrigation), but it is designed to deliver an annual average of up to 2 mgd.

Design is expected to be completed in the spring of 2016, with construction scheduled to begin in the fall of 2017, and deliveries beginning in 2019. The project Environmental Impact Report (EIR) was certified by the San Francisco Planning Commission and approved by the SFPUC's Commission in September 2015. The project team is continuing field assessments of the proposed customer irrigation systems to identify necessary modifications to bring the systems into compliance with regulations related to the distribution and application of recycled water.

6.2.2.3 Eastside Recycled Water Project

In addition to the Westside Recycled Water Project that will provide recycled water to portions of the west side of the City, the SFPUC is planning an Eastside Recycled Water Project to serve a portion of the east side of the City. This project would consist of treatment, storage, and delivery of up to 2 mgd, annual average, of high-quality recycled water to a variety of customers for non-potable irrigation, commercial, and industrial uses. This project is being coordinated with major construction at the Southeast WPCP that is scheduled in the coming years.

6.2.2.4 Non-potable Water

In September 2012, the City adopted the Onsite Water Reuse for Commercial, Multi-family, and Mixed Use Development Ordinance (Ordinance 195-12[14]). Commonly known as the Non-potable Water Ordinance, it added Article 12C to the San Francisco Health Code, allowing for the collection, treatment, and use of alternate water sources for non-potable applications; as well as establishing the Non-potable Water Program. The program provides grant funding for projects meeting specific eligibility criteria.

In October 2013, the ordinance was amended to allow district-scale water systems consisting of two or more buildings sharing non-potable water. Article 12C was further amended in July 2015 to mandate the installation of

[14] San Francisco Health Code, Article 12C, Sections 850-861. Note that this ordinance was amended in October 2013 by Ordinance 208-13 to allow district-scale water systems, and in July 2015 by Ordinance 109-15 to mandate installation of onsite water systems in new development meeting specified criteria

onsite water systems in new developments meeting specified criteria. Beginning November 1, 2015, all new development projects of 250,000 square feet or more of gross floor area located within the boundaries of San Francisco's designated recycled water use areas, as defined by the Recycled Water Ordinance, must install onsite water systems to treat and reuse available alternate water sources for toilet and urinal flushing and irrigation. This requirement expands to the entire City the following year, on November 1, 2016. While not required to install an onsite water system under Article 12C, developments between 40,000 and 250,000 square feet of gross floor area must submit a water budget application and accompanying Water Use Calculator to the SFPUC.

As of March 2016, there are 43 large commercial or multifamily buildings in San Francisco that have installed or shall install an onsite water system in compliance with the Non-potable Water Ordinance. It is anticipated that these 43 buildings will cumulatively result in a potable water offset of 0.14 mgd by 2020. To estimate future potable offset due to compliance with the Non-potable Water Ordinance, SFPUC staff utilized the San Francisco Planning Department's Pipeline Report. The Pipeline Report serves as a barometer for short- and long-term development in San Francisco. Staff determined that there are 24 projects that will be required to comply with the Non-potable Water Ordinance. These 24 projects are estimated to cumulatively result in a potable water offset of approximately 0.26 mgd by 2040. Collectively, the 67 projects will result in a potable water offset of 0.4 mgd by 2040.

For this 2015 UWMP update, this potable water offset is considered a part of the SFPUC's water supply portfolio and is included in **Table 6-7** as non-potable water supplies. However, per direction from DWR, these supplies cannot be reported in the corresponding standardized tables in **Appendix B** because they are not municipally-supplied by the SFPUC.

6.2.2.5 Other Actions to Expand Recycled Water Use

The SFPUC is actively involved in encouraging and expanding recycled water use and onsite water reuse, not only in San Francisco, but throughout the U.S. and internationally. These efforts are described below.

Projects and Partnerships. As demonstrated by the Harding Park and Pacifica Recycled Water Projects, the SFPUC has and will continue to explore opportunities for regional recycled water partnerships with other Bay Area agencies. Through these partnerships, the SFPUC aims to develop recycled water projects that will benefit the SFPUC and partners by reducing demands for RWS supplies and/or freeing up groundwater that could be used for potable supplies.

- **Daly City Recycled Water Expansion:** The SFPUC and NSMCSD have been exploring ways to increase recycled water treatment capacity at the Daly City wastewater treatment plant to serve additional customers and decrease water withdrawals from the Westside Groundwater Basin, both in San Francisco and south of Daly City. A feasibility study identified the capital requirements that would be needed to produce additional capacity at the existing treatment plant location. The study demonstrated that a new tertiary treatment facility located at the wastewater treatment plant would be required to produce additional capacity of up to 3.4 mgd. Currently, flows that exceed the capacity of the existing treatment plant are discharged into the Pacific Ocean. Through this project, some of the discharge may be used beneficially.

Ordinances, Programs, and Services. The SFPUC administers or helps to administer the following ordinances, programs, and services in the City related to recycled water and water reuse. The majority of these ordinances, programs, and services has been established for many years and are ongoing, resulting in increased water reuse.

- **Recycled Water Program and Ordinance:** To encourage the use of recycled water in San Francisco, the City adopted Ordinances 390-91 and 391-91[15]. Collectively referred to as the Recycled Water Ordinance, it requires the installation of dual-plumbed systems within designated areas of the City for new, remodeled or converted buildings; all subdivisions of 40,000 square feet or more; and for new, modified, or existing irrigated areas of 10,000 square feet or more. The number of dual-plumbed systems installed as required by the ordinance continues to increase with the increase of new construction and rehabilitation projects in the City.

- **Soil Compaction and Dust Control Ordinance:** In 1991, the City also passed Ordinance 175-91[16], which restricts the use of potable water for soil compaction and dust control activities for construction and demolition projects. To facilitate the use of non-potable water for these activities, the SFPUC installed a recycled water truck-fill station at its Southeast WPCP. Construction contractors, City departments, and other interested parties may fill water trucks at the station after receiving a permit from the SFPUC.

- **Recycled Water Truck-Fill Station:** Although the truck-fill station had been in place since the 1990s, interest in the station increased during the current drought. In response, the SFPUC constructed an automated fill station in 2014. The station can be accessed 24 hours a day, seven days a week; offers both top- and side-fill options; and dispenses recycled water at 400 gallons per minute. The automated fill station allows access to larger tanker trucks and more users at their convenience. Informational and permitting materials were also updated to clarify what uses are permitted, and how to appropriately handle and use recycled water. As a result, the volume of recycled water dispensed increased from about 300,000 to 739,000 gallons between 2014 and 2015.

- **Large Landscape Grant Program:** The SFPUC initiated a Large Landscape Grant Program in 2009. In-City retail customers with 2.5 acres or more of irrigated landscape are eligible to apply. Grant funding is available for water-saving and recycled water retrofits that reduce potable water use for landscape irrigation. The SFPUC also provides technical assistance in implementing retrofits. The recycled water irrigation system retrofits at both Harding Park and Sharp Park received grant funding through this program.

- **Non-potable Water Program and Ordinance:** As described in **Section 6.2.2.4**, the City adopted the Non-potable Water Ordinance in 2012 to allow for the collection, treatment, and use of alternate water sources for non-potable applications. The Non-potable Water Program outlines the oversight of the SFPUC, the SFDPH, and the San Francisco Department of Building Inspection (SFDBI) during the review process. The ordinance has since been amended to mandate the installation of onsite water systems in new development meeting specified criteria.

- **Public Outreach:** The SFPUC actively promotes its programs to conserve, diversify, and supplement RWS supplies. Marketing campaigns, factsheets, and articles are developed and shared with media, customers, and public officials.

---

[15] San Francisco Public Works Code, Article 22, Sections 1200-1210. Note that this ordinance was amended in 1994 by Ordinance 393-94, which expanded the designated recycled water use area to include Treasure Island, Yerba Buena Island, and Hunters Point Shipyard.

[16] San Francisco Public Works Code, Article 21, Sections 1100-1107.

Research and Knowledge Sharing. The SFPUC is a member of the Bay Area Clean Water Agencies (BACWA) Recycled Water Committee. BACWA is composed of Bay Area wastewater agencies that discharge into the San Francisco Bay estuary. The purpose of the Recycled Water Committee is to provide a forum to share recycled water information and expertise to support and advance regional water recycling efforts. SFPUC staff participates in this committee, and in 2014 through 2015, managed the preparation of the BACWA Recycled Water Truck Facility Location Guide for the Bay Area to help reduce potable water use in the Bay Area

The City is also an active member of the International, California Section, and Northern California Chapters of the WateReuse Association and WateReuse Research Foundation. In addition, SFPUC staff participates on a variety of committees and subcommittees associated with various WateReuse entities. The mission of the WateReuse Association is to educate the public on the importance of reusing water and to advocate for policy, laws, and funding to increase water reuse in communities across the U.S. The mission of the WateReuse Research Foundation is to build support for water reuse through research and education. The California Section focuses on promoting these missions in California.

In May 2014, the SFPUC convened the Innovation in Urban Water Systems Meeting with research institutions and state and municipal government agencies from across North America to discuss the barriers, opportunities, and research needs for onsite water systems with non-potable applications. The group discussed targeted achievable solutions that will provide a path forward toward widespread application of onsite water systems. As a result of the meeting, a document entitled *Blueprint for Onsite Water Systems: A Step-by-Step Guide for Developing a Local Program to Manage Onsite Water Systems* was created. The document serves as a how-to guide for communities interested in implementing an onsite water treatment program.

Currently, the SFPUC is leading a project with the National Water Research Institute to develop recommendations for public health standards for treated alternate water sources for non-potable applications, including water quality criteria, monitoring regimes, and permitting strategies for onsite water systems. The project, Technical Guidance for Public Health Standards for Onsite Water Systems, is sponsored by Water Research Foundation, WateReuse Research Foundation, and Water Environment Research Foundation. The goal of the project is to establish a set of guidelines that can be used by public officials in developing programs to manage and oversee onsite water systems.

Additionally, as a participant in the California Urban Water Agencies' (CUWA) Recycled Water Committee, the SFPUC contributed to the development of the CUWA white paper titled "Potable Reuse Operator Training and Certification Framework." The paper, released in January 2016, summarizes current practices for training and certifying operators of drinking water, wastewater, and potable reuse facilities, and outlines the challenges to implementing standards for certification. The paper also recommends that the SWRCB DDW adopt a standard approach to certification for operators of potable reuse facilities.

6.2.3 Water Quality of Local Supplies

Local groundwater, recycled water, and non-potable water supplies are primarily used for irrigation and other non-potable uses. The SFPUC strives to meet or exceed the quality standards established by State agencies for these end uses, and works closely with regulatory agencies and partners to achieve the highest standards. Water quality of each supply is further described below.

6.2.3.1 Local Groundwater Quality

This section describes the water quality of existing and future groundwater supplies.

Westside Groundwater Basin. Based on semi-annual monitoring, the groundwater currently used for irrigation and other non-potable uses in the City meets or exceeds the quality standards established by State agencies for these end uses.

Groundwater from the Westside Groundwater Basin has been supplying drinking water to Daly City, San Bruno, and South San Francisco for over 60 years, and will soon also serve drinking water to San Francisco. As described previously, the San Francisco Groundwater Supply Project will extract groundwater from the northern portion of the basin for potable supply beginning in 2017. The groundwater will be disinfected and blended with RWS supplies before entering the in-City distribution system. Disinfection with sodium hypochlorite and pH adjustment for corrosion control will be conducted, as is done in the RWS. The quality of the blended water will surpass all health-based drinking water standards set forth by the SWRCB DDW.

A series of groundwater monitoring wells have been installed since 2004 along the Pacific Coast to collect data on the basin's water levels and quality. In addition, the SFPUC has been collecting data from a network of groundwater monitoring wells surrounding Lake Merced since 2001. The SFPUC will continue to monitor these wells when the San Francisco Groundwater Supply Project is put into service to assess how the basin is responding to project operations. All groundwater supplied will meet all health-based drinking water standards after treatment.

The SFPUC's Westside Basin Groundwater Monitoring Program provides information summarizing basin-wide groundwater pumping, groundwater levels, and quality in the different aquifer systems within the basin. This program publishes an annual monitoring report, which may be accessed at www.sfwater.org/groundwater. In addition, the SFPUC is currently preparing a Groundwater Sustainability Plan for the North Westside Basin in compliance with the California Sustainable Groundwater Management Act of 2014 to assure a long-term, high-quality, local water supply for current and future uses.

Castlewood Well System. Groundwater supplies from the Castlewood Well System are disinfected via sodium hypochlorite injection and are potable when delivered to Castlewood CSA. Water quality is monitored weekly by the SFPUC.

Sunol Filter Gallery Subsurface Diversions. Subsurface diversions from the Sunol Filter Gallery are used for irrigation at the Sunol Valley Golf Club and are not treated.

6.2.3.2 Local Recycled Water Quality

This subsection describes the water quality of existing and future recycled water supplies.

Southeast Water Pollution Control Plant. Recycled water produced at the Southeast WPCP is used for in-plant operations and is dispensed via a truck-fill station to construction contractors, City departments, and other interested parties for use within the City. Permitted uses include soil compaction, dust control, landscape irrigation, street cleaning, and sewer flushing. This recycled water is treated to secondary disinfected-23 level and meets the Title 22 California Code of Regulations requirements for approved non-potable uses.

Harding Park. Recycled water produced by NSMCSD's wastewater treatment plant in Daly City is used for irrigation at the Harding Park and Fleming Golf Courses. This tertiary-treated recycled water meets the Title 22 California Code of Regulations (Title 22) requirements for approved non-potable uses.

Sharp Park. Recycled water produced by the City of Pacifica's Calera Creek Water Recycling Plant is used to irrigate a portion of the Sharp Park Golf Course. This tertiary-treated recycled water meets the Title 22 requirements for approved non-potable uses.

Westside Recycled Water Project. Recycled water produced by the Westside Recycled Water Project treatment facility will undergo tertiary treatment, resulting in water quality that meets Title 22 requirements and the needs of the project's planned end uses, including irrigation at Golden Gate Park, Lincoln Park and Golf Course, the Presidio Golf Course, and other landscaped areas at the Presidio.

Eastside Recycled Water Project. Tertiary-level recycled water that would be produced through the Eastside Recycled Water Project would be treated to meet Title 22 requirements and the needs of non-potable end uses, including irrigation, commercial, industrial, and municipal uses.

6.2.3.3 Local Non-potable Water Quality

Onsite water systems are operated, maintained, and monitored by the property owner. Under the Non-potable Water Program, the San Francisco Department of Public Health (SFDPH) has established ongoing monitoring requirements and water quality standards that are protective of public health. Different treatment levels are required depending on the alternate water source and end use. The frequency of monitoring and reporting also vary depending on the alternate water source, and are identified in the SFDPH's *Director's Rules and Regulations Regarding the Operation of Alternate Water Source Systems* and the operating permit for the onsite water system issued by the SFDPH.

6.2.4 Climate Change Impacts to Local Supplies

The SFPUC's primary concern related to climate change is the potential impact to RWS supplies, as addressed in **Section 6.1.6**. Current use of local groundwater, recycled water, and non-potable water supplies is limited. However, implementation of the Groundwater Sustainability Plan for the North Westside Basin will ensure that in-City groundwater supplies are maintained for current and future uses. Recycled water is considered a drought-resistant supply that is not influenced by precipitation or hydrologic year type. Regarding non-potable supplies, rainwater and stormwater are influenced by climate. However, the majority (about 95%) of onsite non-potable reuse achieved through compliance with the Non-potable Water Ordinance is anticipated to be through the use of graywater and blackwater, which are not influenced by climate.

6.2.5 Summary of Existing and Future Local Supplies

Table 6-7 provides a breakdown of current and projected water supply sources for meeting retail water demand through 2040.

Table 6-7. Retail Supplies (mgd)

[Standardized Table 6-4 Retail: Current and Projected Recycled Water Direct Beneficial uses Within Service Area]
[Standardized Table 6-8 Retail: Water Supplies – Actual]
[Standardized Table 6-9 Retail: Water Supplies – Projected]

Retail Supply	Actual	Projected			
	2015	2020	2025	2030	2035	2040
RWS[a]	**67.7**	**70.5**	**71.9**	**73.2**	**76.7**	**80.6**
Groundwater						
San Francisco Groundwater Supply Project[b]	—	4.0	4.0	4.0	4.0	4.0
Westside Groundwater Basin for In-City Irrigation[b]	1.5	0.3	0.3	0.3	0.3	0.3
Castlewood Well System[c]	0.3	0.4	0.4	0.4	0.4	0.4
Sunol Filter Gallery[d]	0.4	0.3	0.3	0.3	0.3	0.3
Subtotal Groundwater	**2.2**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
Recycled Water						
Westside Recycled Water Project	—	1.6	1.6	1.6	1.6	1.6
Eastside Recycled Water Project	—	—	—	2.0	2.0	2.0
Harding Park Recycled Water Project[e]	0.2	0.2	0.2	0.2	0.2	0.2
Pacifica Recycled Water Project[f]	0.0	0.1	0.1	0.1	0.1	0.1
Subtotal Recycled Water[g]	**0.2**	**1.9**	**1.9**	**3.9**	**3.9**	**3.9**
Non-potable Water[h]	**0.0**	**0.1**	**0.2**	**0.2**	**0.3**	**0.4**
Total Retail Supply	**70.1**	**77.5**	**79.0**	**82.3**	**85.9**	**89.9**

a Assuming that the retail supply allocation of 81 mgd per the WSA is extended to 2040, up to 81 mgd of RWS supply may be used.

b About 1.5 mgd of groundwater currently serves irrigation at Golden Gate Park, the San Francisco Zoo, and the Great Highway medians. A reserve of 0.3 mgd for irrigation purposes will remain as part of the non-potable groundwater supply, while 1.2 mgd will be converted to potable supply under the San Francisco Groundwater Supply Project.

c Castlewood CSA is served by the Castlewood Well System.

d Irrigation uses in Sunol (currently the Sunol Valley Golf Club) are served by subsurface diversions from the Sunol Filter Gallery.

e Irrigation at Harding Park and Fleming Golf Courses is provided recycled water from NSMCSD.

f Irrigation at Sharp Park Golf Course is provided recycled water from NCCWD. Approximately 0.01 mgd was provided in 2015 after deliveries began in October 2014.

g A small amount of recycled water is dispensed from the Southeast Water Pollution Control Plan recycled water truck-fill station for various approved uses, but the annual volume is not considered large enough to be reported in the 2015 UWMP (about 739,000 gallons, or 0.002 mgd, in 2015).

h Non-potable water indicates onsite water reuse as mandated by the Non-potable Water Ordinance. Non-potable water is not supplied by the SFPUC, and is therefore not included in the corresponding standardized tables in **Appendix B**.

SECTION 7: WATER SUPPLY RELIABILITY

This section describes the reliability of the RWS and local supplies to meet retail and wholesale demands through the year 2040. As described previously, supplies to meet retail demands come from the RWS and local water supply sources, including groundwater and recycled water. Approximately one third of the SFPUC's RWS supply is delivered to retail customers, and the remaining two thirds is delivered to wholesale customers. Water supply reliability is described for normal year (i.e., average year), single dry year, and multiple dry year conditions.

As explained in **Section 2.4**, Groveland CSD is accounted for as a retail customer in this section, but as a wholesale customer in the corresponding standardized tables in **Appendix B**.

7.1 RWS AND LOCAL SUPPLY RELIABILITY

Reliability of the RWS is expressed in terms of the system's ability to deliver water during droughts. Reliability may be quantified by the amount and frequency of water delivery reductions (i.e., deficiencies) required to balance customer demands with available supplies. The SFPUC plans deliveries under the premise that a drought more severe than the worst drought on record may occur. Potential system-wide and retail deficiencies are described in this section.

7.1.1 Constraints on Supplies

The list below summarizes the legal, environmental, water quality, climatic, and other factors potentially resulting in inconsistent supply.

- **RWS:** As described previously, RWS supplies may be reduced due to required instream flow releases (see **Section 6.1.4**) as well as climate change (see **Section 6.1.6**).

- **Water Transfers:** Institutional arrangements governing potential water transfers may affect their availability, and climatic variability may impact the availability of surface water in some years.

- **Groundwater:** Groundwater supplies are typically limited by the quality and quantity of available supplies. However, the probability of these impacts occurring is low with proper management of the Westside Groundwater Basin as described in **Section 6.2.1.1**. Additionally, to maintain consistent water quality in the blended supply produced by the San Francisco Groundwater Supply Project, groundwater supplies will be proportionate with RWS supplies (i.e., if RWS supplies are reduced, groundwater supplies will also be reduced).

- **Recycled Water:** Recycled water is limited by water quality requirements that legally restrict recycled water supply for some uses. However, recycled water supplies discussed herein are treated, or are planned to be treated, to the standards established by State agencies that are required for each designated end use. As a result, no limitations on use of recycled water for designated purposes are expected to occur.

- **Non-potable Water:** Similar to recycled water, non-potable water is limited by water quality requirements that legally restrict non-potable water supply for some uses. However, non-potable water supplies discussed herein are treated, or are planned to be treated, to the standards established by the SFPDH required for each designated end use. Therefore, no water quality limitations on non-potable water supplies are expected to occur. However, climate change may influence the availability of rainwater and stormwater as alternate water sources. The majority (about 95%) of potable offset anticipated due to non-

potable reuse is from alternate water sources, such as graywater and blackwater, which are not impacted by climate change, and therefore a minimal reduction in offset is expected during dry years. Furthermore, make-up water for onsite water systems that are located within the boundaries of San Francisco's designated recycled water use areas would by supplied by municipal potable water or recycled water through the Westside and Eastside Recycled Water Projects when available.

7.1.2 Estimating the Frequency and Magnitude of RWS Supply Deficiencies

The total amount of water the SFPUC has available to deliver to retail and wholesale customers during a defined period of time depends on several factors, including the amount of water that is available to the SFPUC from natural runoff, the amount of water in reservoir storage, and the amount of that water that must be released from the RWS for purposes other than customer deliveries (e.g., required instream flow releases below RWS reservoirs).

For planning purposes, the SFPUC "normal year" is based on historical hydrology under conditions that allow the reservoirs to be filled over the course of the snowmelt season, allowing full deliveries to customers.

The 1987-92 drought profoundly highlighted the discrepancy between the SFPUC's supplies and its customers' demands. Other than during the drought of 1976-77, drought sequences in the past did not seriously affect the ability of the RWS to sustain full deliveries to its retail and wholesale customers. Based on the 1987-92 drought experience, the SFPUC assumes its "firm" capability to be the amount the RWS can be expected to deliver during historically-experienced drought periods. In estimating this firm capability, the SFPUC assumes the potential occurrence of a drought that is more severe than what the RWS has historically experienced. This drought sequence is referred to as the "design drought" and serves as the basis for planning and modeling of future drought scenarios. While the most recent drought currently underway consists of some of the driest years in sequence on record, for the SFPUC's watersheds, the design drought still represents a more severe drought.

7.1.3 Design Drought

The 1987-92 drought defines the most extreme recorded drought for RWS deliveries, and establishes the basis for the development of a design drought sequence that is more severe than the worst drought on record. The 1987-92 drought covered a 6.5-year period from July 1986 (when the RWS reservoirs were full) to about November/December 1992 (when the RWS reservoirs reached minimum storage). Although the RWS reservoirs began to recover with precipitation during the last six months of the drought, from July 1992 through December 1992, SFPUC customer purchases exceeded RWS inflow during this period, and RWS storage continued to decline through November/December 1992. Because the last six months of the 1987-92 drought includes the beginning of this recovery period, it is excluded from the design drought.

In summary, the design drought sequence used by the SFPUC for reliability planning totals an 8.5-year period and is based on the following factors:

- **Historical Hydrology:** The six years of hydrology from the historical drought (July 1986 to June 1992);
- **Prospective Drought:** A 2.5-year period which includes the 1976-1977 drought (to represent a drought sequence worse than historical); and
- **System Recovery Period:** The last six months of the design drought are the beginning of the system recovery period. The precipitation begins in the fall, and by approximately the month of December, inflow to RWS reservoirs exceeds customer demands and SFPUC system storage begins to recover.

The SFPUC plans its water deliveries anticipating that the design drought will occur at the start of each water year. As a result, the SFPUC system operations are designed for providing sufficient carry-over water in SFPUC reservoirs after six years of drought. This design would enable the SFPUC to continue delivering water, although at significantly reduced levels, during and after such a drought.

Table 7-1 summarizes the expected availability of RWS and local groundwater, recycled water, and non-potable water supplies under normal, single dry, and multiple dry year conditions. The SFPUC currently operates under a plan that anticipates multiple stages of response to water supply shortages, ranging from use of dry year water supplies (when available) and voluntary customer water reductions to enforced rationing. Assuming the availability of existing supplies at current demand levels, the SFPUC system can expect shortages of at least 10 to 22% in multiple dry water years. Implementation of WSIP, discussed in the next section and shown in **Table 7-3**, will improve the SFPUC's water supply reliability, particularly in the earlier years of the design drought. However, as the design drought progresses, the SFPUC will continue to experience multiple years of 10 to 20% rationing.

Table 7-1. Water Supply Availability During Normal and Dry Years

[Standardized Table 7-1 Retail: Bases of Water Year Data]

[[Standardized Table 7-1 Wholesale: Bases of Water Year Data]

Water Supply	Normal Year	Single Dry Year	Multiple Dry Years		
			Year 1	Year 2	Year 3
Base Year 2015 (substantial WSIP completion)					
RWS[a]	100%	90%	90%	78%	78%
Local Groundwater[b]	100%	100%	100%	100%	100%
Local Recycled Water[b]	100%	100%	100%	100%	100%
Non-potable Water[b, c]	100%	<100%	<100%	<100%	<100%
Projected Years 2020 through 2040 (post-WSIP completion)					
RWS[a]	100%	90%	90%	80%	80%
Local Groundwater[b]	100%	100%	100%	100%	100%
Local Recycled Water[b]	100%	100%	100%	100%	100%
Non-potable Water[b, c]	100%	<100%	<100%	<100%	<100%

Normal, single dry, and multiple dry year conditions are on a water year basis. Dry year availability is presented in terms of percentage of normal year availability.

a RWS supplies are available to meet both retail and wholesale demands. Retail and wholesale allocations are provided in **Section 8.3** (**Table 8-2** and **Table 8-5**, respectively)

b Local supplies are available only to meet retail demands.

c Non-potable water supplies would be minimally affected by dry year conditions as the majority of the supplies is anticipated to be comprised of graywater and blackwater.

7.2 DRY YEAR WATER SUPPLY PROJECTS

As an established major water supplier for the Bay Area region, the SFPUC is responsible for securing and managing its existing system supplies and planning for future needs, as well as securing its own retail supply.

The WSIP provides goals and objectives to improve the supply reliability and delivery reliability of the RWS, presented previously in **Table 6-1**. The goal and objectives related to water supply are highlighted in **Table 7-2**.

Table 7-2. Water System Improvement Program Goals and Objectives Related to Water Supply
[Standardized Table Not Applicable]

Program Goal	System Performance Objective
Water Supply: meet customer water needs in non-drought and drought periods	• Meet average annual demand of 265 mgd from the SFPUC watersheds for retail and Wholesale Customers during nondrought years for system demands through 2018. • Meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20% system-wide reduction in water service during extended droughts. • Diversify water supply options during non-drought and drought periods. • Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers.

The adopted WSIP included several water supply elements to address the WSIP water supply goals and objectives, which together will allow the SFPUC to meet at least 80% of its customer demand during droughts. The SFPUC will continue to rely on rationing up to no more than 20% in any one year of a drought. Dry year water supply projects identified in the WSIP were subsequently evaluated in the PEIR. Descriptions and the current status of each of these projects are provided in the sections below. Supply availability for each project is summarized in **Table 7-3.**

Table 7-3. Availability of WSIP Dry Year Water Supply Projects (mgd)
[Standardized Table Not Applicable]

	Actual	Projected				
Water Supply[a]	2015	2020	2025	2030	2035	2040
Calaveras Reservoir at Full Capacity	—	7.0	7.0	7.0	7.0	7.0
Alameda Creek Recapture	—	9.3	9.3	9.3	9.3	9.3
Crystal Springs Reservoir at Full Capacity[b]	—		0.5	0.5	0.5	0.5
Regional Groundwater Storage and Recovery Project	—	7.2	7.2	7.2	7.2	7.2
Water Transfers	—	2.0	2.0	2.0	2.0	2.0

a The Lake Merced Water Level Restoration Project is not listed in this table. For more information, see **Section 7.2.5**.

b Schedule for restoration of Crystal Springs Reservoir storage is tied to permitting requirements for endangered plants.

In addition, specific actions to expand recycled water use, described previously in **Section 6.2.2.5**, would help offset retail demands on RWS supplies if implemented.

7.2.1 Calaveras Dam Replacement Project

The adopted WSIP includes the Calaveras Dam Replacement Project, which will replace the seismically-deficient Calaveras Dam and restore the reservoir capacity from 38,100 AF to 96,850 AF, returning nearly 60,000 AF of reservoir storage to the RWS. The restored capacity will restore up to 7 mgd per year of storage for emergency

and drought water supplies in each of the last 7.5 years of the design drought. Once key project milestones are reached, the SFPUC must adhere to a flow release schedule established through Biological Opinions and permits with the National Marine Fisheries Service and the California Department of Fish and Wildlife. As described in **Section 6.1.4**, an average annual rate of 9.3 mgd of instream flows will be needed to meet water release requirements at Calaveras Dam and bypass of flow at Alameda Creek Diversion Dam, which diverts water from Upper Alameda Creek to storage in Calaveras Reservoir.

The project EIR was certified in 2011, and construction is now underway. Construction of the new dam is slated for completed in 2018, while the entire project should be completed in 2019.

7.2.2 Alameda Creek Recapture Project

The Alameda Creek Recapture Project[17] would recapture the 9.3 mgd of RWS yield lost due to instream flow released at Calaveras Dam or bypassed around the Alameda Creek Diversion Dam, and return this yield to the RWS through facilities in the Sunol Valley. Water that naturally infiltrates from Alameda Creek would be recaptured into an existing quarry pond. The project is designed to allow the recaptured water to be pumped to the SVWTP or to San Antonio Reservoir. The project Draft EIR is anticipated to be released in the spring of 2016, with construction occurring between spring 2017 and fall 2018.

7.2.3 Lower Crystal Springs Dam Improvements Project

The Lower Crystal Springs Dam Improvements Project will restore 7,400 AF of capacity in Lower Crystal Springs Reservoir that was formerly achieved through the use of stop logs in the reservoir spillway. The restored capacity will serve as storage for emergency and drought water supplies, providing up to an additional 0.5 mgd in each of the last 7.5 years of the design drought. The Biological Opinion issued by the National Marine Fisheries Service resulted in an annual average release of 3.5 mgd to San Mateo Creek to satisfy modified instream flow release requirements, as described in **Section 6.1.4**. The SFPUC began making the required flow releases to San Mateo Creek in January 2015.

The Lower Crystal Springs Dam Improvements were substantially completed in November 2011. However, reservoir permitting issues have become significant. While the reservoir elevation was lowered due to DSOD restrictions, the habitat for the Fountain Thistle, an endangered plant species, followed the lowered reservoir elevation. Raising the reservoir elevation now requires that new plant populations be restored incrementally before proceeding with the raise. As a result, it may be several years before the original elevation can be restored.

7.2.4 Regional Groundwater Storage and Recovery Project

The Regional Groundwater Storage and Recovery Project is an in-lieu conjunctive use project that will balance the management of both groundwater and surface water resources in a way that safeguards supplies during times of drought. It is a strategic partnership between the SFPUC and three partner agencies in San Mateo County that pump water from the South Westside Groundwater Basin: the California Water Service Company (serving South San Francisco and Colma), the City of Daly City, and the City of San Bruno. The partner agencies currently purchase RWS supplies on a wholesale basis from the SFPUC and also independently operate groundwater production wells for drinking water and irrigation.

The project will extract stored groundwater from the South Westside Basin for delivery to the RWS and the partner agencies. During years of normal or wet hydrologic years, the project will provide RWS supplies to the partner agencies to reduce the amount of groundwater pumped, resulting in in-lieu recharge of the aquifer. Over

[17] The project formerly known as the Upper Alameda Creek Filter Gallery Project in the WSIP was later reconceived as the Alameda Creek Recapture Project

time, the reduced pumping will result in the storage of up to 61,000 AF of water; this volume is more than the supply contained in the Crystal Springs Reservoir. The project consists of installing up to 16 new wells to pump the stored groundwater during a drought, in addition to construction of well pumps, disinfection units, and piping. The new wells would allow recovery of the stored water at a rate of up to 7.2 mgd in each of the last 7.5 years of the design drought.

The project EIR was certified in April 2014, and construction began in April 2015. This project is expected to be online in 2018.

7.2.5 Lake Merced Water Level Restoration Project

This project consists of two proposed design alternatives which are under review by the SFPUC and the City of Daly City. The Lake Merced Alternative (i.e., the Vista Grande Drainage Basin Improvement Project) is intended to manage Daly City stormwater and provide treated and untreated stormwater to augment water levels in Lake Merced. In 2012, the SFPUC entered into a Memorandum of Understanding with the City of Daly City to assist in a detailed assessment of environmental impacts of various target lake levels, and to evaluate lake management and operational strategies. In February 2013, Daly City issued a Notice of Preparation/Notice of Intent, declaring the intent by both Daly City as the Lead Agency under the CEQA, and the National Park Service as the Lead Agency under the National Environmental Policy Act (NEPA), to prepare a joint Environmental Impact Report/Environmental Impact Statement (EIR/EIS). The SFPUC completed review of Daly City's Administrative Draft EIR/EIS document in the spring of 2015. Daly City currently anticipates release of the Draft EIR/EIS document in December 2015.

The SFPUC is also proposing the installation of an Aeration Mixing System in Lake Merced to assist in improving dissolved oxygen levels in the lower portion of the lake which are currently low as a result of seasonal lake stratification. The SFPUC is currently evaluating alternatives and will begin required environmental review once an alternative has been identified. A full re-evaluation of the project's status, description, schedule and costs will be undertaken once the alternatives have been sufficiently evaluated.

7.2.6 Water Transfers

The proposed WSIP evaluated in the PEIR included a drought year water transfer with MID and/or TID of 25 mgd on an average annual basis during the design drought to meet drought year water delivery under the scenario in which demand was expected to be 300 mgd. The Phased WSIP, however, only included a 2 mgd dry year transfer as that was the dry year need associated with meeting a demand of 265 mgd.

The SFPUC initially pursued a long-term agreement to transfer 2 mgd from MID in dry years only. The negotiations were terminated in 2012. Subsequently, the SFPUC has initiated discussions with the Oakdale Irrigation District (OID) to secure a similar dry year transfer for 2 mgd. While no transfer has been secured to date, the SFPUC continues to pursue discussions with partners to explore potential transfer opportunities on the Tuolumne River and throughout the San Joaquin Valley. For the purpose of this 2015 UWMP, it is assumed that a 2 mgd dry year transfer will be secured as part of the implementation of the Phased WSIP.

7.3 INSTREAM FLOW RELEASE AND BYPASS REQUIREMENTS

As described previously, implementation of the Calaveras Dam Replacement Project and Lower Crystal Springs Dam Improvements Project will require the SFPUC to adhere to specific flow schedules in accordance with permit requirements. The current instream flow release and bypass requirements for Alameda Creek and San Mateo Creek will result in the release of flows at an average annual rate of 9.3 mgd and 3.5 mgd, respectively. These releases are greater than what was previously planned for in the Phased WSIP, and could result in a

corresponding unanticipated decrease in available RWS supplies over the course of the design drought. However, the Alameda Creek Recapture Project is proposed to recapture the average annual volume of water that will be released from storage in Calaveras Dam and bypassed from diversion at the Alameda Creek Diversion Dam. If, following the project-level environmental review for the Alameda Creek Recapture Project, the SFPUC approves implementation of the project as designed, the revised flow schedules would result in a net decrease in available water supply of 3.5 mgd associated with the flow schedule for the Lower Crystal Springs Dam Improvements Project.

The SFPUC's participation in Bay Area efforts to improve regional water supply reliability, which are described in the next section, may help make up for this 3.5 mgd shortfall. Furthermore, actions resulting from the WaterMAP, described in **Section 7.7.1**, may include the development of a new water supply program with additional supply projects beyond those identified in the adopted WSIP.

7.4 BAY AREA REGIONAL EFFORTS TO IMPROVE WATER SUPPLY RELIABILITY

The following projects and efforts are currently underway or completed and will help the RWS meet its water supply reliability needs. Some of these projects are reflected in the SFPUC's current strategy for meeting water supply needs. As the remainder of these projects move through the planning stages, they will continue to inform water supply strategy.

7.4.1 Long-Term Reliable Water Supply Strategy

In 2009, BAWSCA, on behalf of the Wholesale Customers, began developing a Strategy to identify appropriate water management actions to increase the long-term water supply reliability of its member agencies and their customers under normal and drought conditions.

BAWSCA's Strategy was developed to quantify the water supply reliability needs of the BAWSCA member agencies through 2040, identify the water supply management projects and/or programs that could be developed to meet those needs, and prepare an implementation plan for the Strategy's recommendations. Successful implementation of the Strategy is critical to ensuring that there will be sufficient and reliable water supplies for the BAWSCA member agencies and their customers in the future.

The project evaluation analysis done as part of the Strategy resulted in the following key findings:

- Water transfers score consistently high across the various performance measures and within various portfolio constructs and thus represent a high priority element of the Strategy.

- Desalination of brackish supplies also potentially provides substantial yield, but its high effective costs and intensive permitting requirements make it a less attractive drought year supply alternative. However, given the limited options for generating significant yield for the region, desalination warrants further investment in information as a hedge against the loss of local or other imported supplies.

- The other potential regional projects provide tangible, though limited, benefit in reducing dry year shortfalls given the small average yields in drought years.

BAWSCA is now implementing the Strategy recommendations in coordination with BAWSCA member agencies. Strategy implementation will be adaptively managed to account for changing conditions and to ensure that the goals of the Strategy are met efficiently and cost-effectively.

7.4.2 Bay Area Regional Reliability

The SFPUC is working with seven water agencies in the Bay Area (ACWD, BAWSCA, CCWD, EBMUD, MMWD, SCVWD and Zone 7 Water Agency) to investigate opportunities for collaboration. The purpose of this planning effort, known as Bay Area Regional Reliability (BARR), is to identify projects and processes to enhance water supply reliability across the region, leverage existing infrastructure investments, facilitate water transfers during critical shortages, and improve climate change resiliency. Projects to be considered will include interagency interties and pipelines; treatment plant improvements and expansion; groundwater management and recharge; potable reuse; desalination; and water transfers. While no specific capacity or supply has been identified, this program may result in the addition of future supplies that would benefit SFPUC customers.

7.4.3 Regional Interties

Regional interties help increase the reliability of the RWS by allowing for water exchanges during emergencies, water shortages, or maintenance.

- **EBMUD-Hayward-SFPUC Intertie:** In 2002, the SFPUC formed a partnership with EBMUD and the City of Hayward to construct Skywest Pump Station and 1.5 miles of pipeline to link their systems. These facilities are now completed and can convey up to 30 mgd among these three agencies to boost water supply reliability when needed. EBMUD and the SFPUC own these facilities jointly, while the City of Hayward maintains and operates them in coordination with EBMUD and the SFPUC.

- **SCVWD Intertie:** The SFPUC and SCVWD constructed a 40-mgd intertie between their two systems to exchange water during emergencies and planned maintenance. The intertie has been used during maintenance of one of SCVWD's water treatment plants.

- **South Bay Aqueduct Interties:** In the past, the SFPUC used one permanent and one temporary intertie to the South Bay Aqueduct for water transfers, which, if reactivated, would enable the SFPUC to receive supplies from the State Water Project.

7.4.4 Bay Area Integrated Regional Water Management Plan

The SFPUC is an active participant in the nine-county Bay Area Integrated Regional Water Management planning process. The BAIRWMP was first completed in November 2006 and most recently updated in September 2013. The BAIRWMP describes the region's water supply and water quality, wastewater and water recycling, storm water and flood protection, and habitat protection and ecosystem restoration objectives and efforts. The BAIRWMP also identifies integrated and collaborative projects among Bay Area agencies. To date, the Bay Area has received $148.5 million in Propositions 50 and 84 Integrated Regional Water Management (IRWM) implementation grant funding. More recently, the Bay Area received $65 million in Proposition 1 IRWM grant funding for implementation, planning, and disadvantaged community involvement efforts.

7.5 RETAIL WATER SUPPLY AND DEMAND COMPARISON

Table 7-4 summarizes the projected retail supplies and demands during normal, single dry, and multiple dry years. Total retail demands are estimated in **Section 4.1** and reflect passive and active conservation, as well as water loss. Supplies are listed by source: RWS, groundwater, recycled water, and non-potable water. The difference between supply and demand, resulting in either a supply surplus or deficit, is also provided for each projected year and dry year scenario.

Procedures to allocate RWS supplies between retail and wholesale customers during system shortages are specified in the SFPUC's Water Shortage Allocation Plan (WSAP) Among Suburban Customers, which is described in **Section 8.3**. As noted earlier, Groveland CSD is accounted for as a retail customer in this section, but, but as a wholesale customer in the corresponding standardized tables in **Appendix B**.

The SFPUC would use local groundwater, recycled water, and non-potable water supplies before using RWS supplies to meet retail demands. Although up to 81 mgd of RWS supplies are available in normal years, the SFPUC is committed to developing local supplies to meet retail demands.

In general, **Table 7-4** demonstrates the following:

- **Normal Years:** During normal precipitation years, the SFPUC will have adequate supplies to meet its projected retail water demands.
- **Single Dry Year:** During single dry years, there would be no shortage in RWS deliveries. The SFPUC would have sufficient supplies to meet retail demands in single dry years.
- **Multiple Dry Years:** If a multiple dry year event occurs, the SFPUC would experience shortages in RWS deliveries in 2040 during years 2 and 3 without development of additional supply concepts. A shortfall of 1.1 mgd, or 1.2% of demand, would be experienced.

Table 7-4. Retail Supply and Demand Comparison for Projected Normal and Dry Year Scenarios (mgd)

[Standardized Table 7-2 Retail: Normal Year Supply and Demand Comparison]
[Standardized Table 7-3 Retail: Single Dry Year Supply and Demand Comparison]
[Standardized Table 7-4 Retail: Multiple Dry Years Supply and Demand Comparison]

Year	Retail Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years Year 1[a]	Multiple Dry Years Year 2[b]	Multiple Dry Years Year 3[b]
2020	Total Retail Demand[c]	77.5	77.5	77.5	77.5	77.5
	RWS Supply[d]	70.5	70.5	70.5	70.5	70.5
	Groundwater Supply[e]	5.0	5.0	5.0	5.0	5.0
	Recycled Water Supply[f]	1.9	1.9	1.9	1.9	1.9
	Non-potable Water Supply[g]	0.1	0.1	0.1	0.1	0.1
	Total Retail Supply	77.5	77.5	77.5	77.5	77.5
	Difference (Surplus or Shortfall)	**0**	**0**	**0**	**0**	**0**
	Difference as % of Demand	**0%**	**0%**	**0%**	**0%**	**0%**
2025	Total Retail Demand[c]	79.0	79.0	79.0	79.0	79.0
	RWS Supply[d]	71.9	71.9	71.9	71.9	71.9
	Groundwater Supply[e]	5.0	5.0	5.0	5.0	5.0
	Recycled Water Supply[f]	1.9	1.9	1.9	1.9	1.9
	Non-potable Water Supply[g]	0.2	0.2	0.2	0.2	0.2
	Total Retail Supply	79.0	79.0	79.0	79.0	79.0
	Difference (Surplus or Shortfall)	**0**	**0**	**0**	**0**	**0**
	Difference as % of Demand	**0%**	**0%**	**0%**	**0%**	**0%**
2030	Total Retail Demand[c]	82.3	82.3	82.3	82.3	82.3
	RWS Supply[d]	73.2	73.2	73.2	73.2	73.2
	Groundwater Supply[e]	5.0	5.0	5.0	5.0	5.0
	Recycled Water Supply[f]	3.9	3.9	3.9	3.9	3.9
	Non-potable Water Supply[g]	0.2	0.2	0.2	0.2	0.2
	Total Retail Supply	82.3	82.3	82.3	82.3	82.3
	Difference (Surplus or Shortfall)	**0**	**0**	**0**	**0**	**0**
	Difference as % of Demand	**0%**	**0%**	**0%**	**0%**	**0%**
2035	Total Retail Demand[c]	85.9	85.9	85.9	85.9	85.9
	RWS Supply[d]	76.7	76.7	76.7	76.7	76.7
	Groundwater Supply[e]	5.0	5.0	5.0	5.0	5.0
	Recycled Water Supply[f]	3.9	3.9	3.9	3.9	3.9
	Non-potable Water Supply[g]	0.3	0.3	0.3	0.3	0.3
	Total Retail Supply	85.9	85.9	85.9	85.9	85.9
	Difference (Surplus or Shortfall)	**0**	**0**	**0**	**0**	**0**
	Difference as % of Demand	**0%**	**0%**	**0%**	**0%**	**0%**

Table 7-4 (continued)

Year	Retail Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years Year 1[a]	Year 2[b]	Year 3[b]
2040	Total Retail Demand[c]	89.9	89.9	89.9	89.9	89.9
	RWS Supply[d]	80.6	80.6	80.6	79.5	79.5
	Groundwater Supply[e]	5.0	5.0	5.0	5.0	5.0
	Recycled Water Supply[f]	3.9	3.9	3.9	3.9	3.9
	Non-potable Water Supply[g]	0.4	0.4	0.4	0.4	0.4
	Total Retail Supply	89.9	89.9	89.9	88.8	88.8
	Difference (Surplus or Shortfall)	**0**	**0**	**0**	**-1.1**	**-1.1**
	Difference as % of Demand	**0%**	**0%**	**0%**	**-1.2%**	**-1.2%**

Normal, single dry, and multiple dry year conditions are on a water year basis.

a During a single dry year and multiple dry year 1, a system-wide shortage of 10% is in effect. Under the WSAP, the retail supply allocation at this stage of shortage is 36.0% of available RWS supply, or 85.9 mgd. However, due to the Phased WSIP Variant, only 81 mgd of RWS supply can be delivered. RWS supply is capped at this amount.

b During multiple dry years 2 and 3, a system-wide shortage of 20% is in effect. Under the WSAP, the retail supply allocation at this stage of shortage is 37.5% of available RWS supply, or 79.5 mgd. RWS supply is capped at this amount.

c Total retail demands correspond to those in **Table 4-1**, and reflect both passive and active conservation, as well as water loss. Groveland CSD is included in the table above. However, in the corresponding standardized tables in **Appendix B**, Groveland CSD is accounted for as a wholesale customer instead of a retail customer, as explained in **Section 2.4**.

d Procedures for RWS allocations and the WSAP are described in **Section 8.3**. Groundwater and recycled water are assumed to be used before RWS supplies to meet retail demand. However, if groundwater and recycled water supplies are not available, up to 81 mgd of RWS supply could be used.

e Groundwater supplies are assumed to be equivalent to projected demands for the San Francisco Groundwater Supply Project (4.0 mgd), San Francisco Zoo (0.3 mgd), Castlewood CSA (0.4 mgd), and subsurface diversions in Sunol (0.3 mgd). Groundwater availability would not be affected by dry year conditions.

f Recycled water supplies are assumed to be equivalent to projected demands related to the Westside Recycled Water Project (1.6 mgd), Eastside Recycled Water Project (2.0 mgd), Harding Park and Fleming Golf Courses (0.23 mgd), and Sharp Park Golf Course (up to 0.08 mgd by 2020). Recycled water availability would not be affected by dry year conditions.

g Non-potable water indicates onsite water reuse as mandated by the Non-potable Water Ordinance. Non-potable water availability would be minimally affected by dry year conditions. Non-potable water is not supplied by the SFPUC, and is therefore not included in the corresponding standardized tables in **Appendix B**.

7.6 WHOLESALE WATER SUPPLY AND DEMAND COMPARISON

Table 7-5 summarizes the projected wholesale supplies and demands during normal, single dry, and multiple dry years. Total wholesale demands, are estimated in **Section 4.2** and reflect the Supply Assurance of 184 mgd for Wholesale Customers. The difference between supply and demand, resulting in either a supply surplus or deficit, is also provided for each projected year and dry year scenario.

As noted previously, procedures to allocate RWS supplies between retail and wholesale customers during system shortages are specified in the WSAP described in **Section 8.3**. Groveland CSD is accounted for as a retail customer in **Table 7-4**, above, but as a wholesale customer in the corresponding standardized tables in **Appendix B**.

Table 7-5 does not reflect decisions specified in the WSA that will be made in 2018 regarding additional supplies to Wholesale Customers in excess of the Supply Assurance of 184 mgd or converting the Cities of San Jose and Santa Clara to permanent customers. If the SFPUC determines that it will serve more than 184 mgd to the Wholesale Customers, this, in combination with supplies to retail customers, may result in a demand above 265 mgd. Thus, the SFPUC would need to develop the additional water supplies to continue meeting the water supply Levels of Service. As these decisions have not yet been made, the SFPUC's reliability analysis carries the current Supply Assurance forward through 2040 and does not factor either the development of additional water supplies beyond those necessary to meet demands through 2018 or meeting demands in excess of the Supply Assurance.

In general, **Table 7-5** demonstrates the following:

- **Normal Years:** During normal hydrologic years, the SFPUC will have adequate supplies to meet its projected wholesale water demands.
- **Single Dry Year:** During single dry years, there would be shortages in RWS deliveries to wholesale customers for all projected years. The resulting shortfall would be 31.4 mgd, or 17.1% of demand.
- **Multiple Dry Years:** In a multiple dry year event, wholesale customers would collectively experience shortages in RWS deliveries for all projected years. The shortage in year 1 would be equivalent to that during a single dry year, resulting in a shortfall of 31.4 mgd, or 17% of demand. A greater level of shortage would be experienced in years 2 and 3, resulting in a shortfall of 51.5 mgd, or 28.0% of demand.

Table 7-5. Wholesale Supply and Demand Comparison for Projected Normal and Dry Year Scenarios (mgd)

[Standardized Table 7-2 Wholesale: Normal Year Supply and Demand Comparison]
[Standardized Table 7-3 Wholesale: Single Dry Year Supply and Demand Comparison]
[Standardized Table 7-4 Wholesale: Multiple Dry Years Supply and Demand Comparison]

Year	Wholesale Supply and Demand	Normal Year	Single Dry Year[a]	Multiple Dry Years Year 1[a]	Year 2[b]	Year 3[b]
2020	Total Wholesale Demand[c]	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[d]	184.0	152.6	152.6	132.5	132.5
	Difference (Surplus or Shortfall)	**-0.0**	**-31.4**	**-31.4**	**-51.5**	**-51.5**
	Difference as % of Demand	**0.0%**	**-17.1%**	**-17.1%**	**-28.0%**	**-28.0%**
2025	Total Wholesale Demand[c]	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[d]	184.0	152.6	152.6	132.5	132.5
	Difference (Surplus or Shortfall)	**-0.0**	**-31.4**	**-31.4**	**-51.5**	**-51.5**
	Difference as % of Demand	**0.0%**	**-17.1%**	**-17.1%**	**-28.0%**	**-28.0%**
2030	Total Wholesale Demand[c]	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[d]	184.0	152.6	152.6	132.5	132.5
	Difference (Surplus or Shortfall)	**-0.0**	**-31.4**	**-31.4**	**-51.5**	**-51.5**
	Difference as % of Demand	**0.0%**	**-17.1%**	**-17.1%**	**-28.0%**	**-28.0%**
2035	Total Wholesale Demand[c]	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[d]	184.0	152.6	152.6	132.5	132.5
	Difference (Surplus or Shortfall)	**-0.0**	**-31.4**	**-31.4**	**-51.5**	**-51.5**
	Difference as % of Demand	**0.0%**	**-17.1%**	**-17.1%**	**-28.0%**	**-28.0%**
2040	Total Wholesale Demand[c]	184.0	184.0	184.0	184.0	184.0
	Total Wholesale RWS Supply[d]	184.0	152.6	152.6	132.5	132.5
	Difference (Surplus or Shortfall)	**-0.0**	**-31.4**	**-31.4**	**-51.5**	**-51.5**
	Difference as % of Demand	**0.0%**	**-17.1%**	**-17.1%**	**-28.0%**	**-28.0%**

Normal, single dry, and multiple dry year conditions are on a water year basis.

Groveland CSD is not accounted for as a wholesale customer for the purpose of this table. Refer to **Table 7-4** the retail supply and demand comparison including Groveland CSD. However, in the corresponding standardized tables **in Appendix B**, Groveland CSD is reported as wholesale rather than retail.

a Single dry year and multiple dry year 1 reflect a system-wide shortage of 10%. Under the WSAP, the wholesale supply allocation at this stage of shortage is 64.0% of available RWS supply, or 152.6 mgd.

b Multiple dry years 2 and 3 reflect a system-wide shortage of 20%. Under the WSAP, wholesale supply allocation at this stage of shortage is 62.5% of available RWS supply, or 132.5 mgd.

c Total wholesale demands correspond to those in **Table 4-3**. It is assumed that 265 mgd demand will extend beyond 2018, and projected Wholesale Customer demands are limited to the Supply Assurance of 184 mgd. The 184 mgd assumes that San Jose and Santa Clara remain temporary, interruptible customers.

d Procedures for RWS allocations and the WSAP are described in **Section 8.3**.

7.7 FUTURE ACTIONS AFFECTING WATER SUPPLY AND DEMAND

The supply and demand comparisons above are based on assumptions that reflect decisions made to date. There are a multitude of upcoming actions that affect RWS supplies and may increase demands on the RWS. These actions are described below.

7.7.1 2018 Water Supply Decisions

As noted in **Section 4.2.1.2**, the SFPUC committed to making certain decisions by December 31, 2018 under the 2009 WSA. Additionally, changes to instream flow requirements and customer demand projections that surfaced after the effective date of the WSA will redirect water supply planning beyond 2018. As a result, the SFPUC has developed the WaterMAP to provide necessary information to address the 2018 decisions and to begin developing a water supply program for the 2019 to 2035 planning horizon. The water supply program will enable the SFPUC to continue to meet its commitments and responsibilities to the Wholesale Customers and retail customers, consistent with the priorities of the SFPUC.

The WaterMAP poses the following questions to help guide the decision-making process:

- **How should the SFPUC maintain delivery reliability while addressing reduction in supply availability caused by new instream flow reductions?**

  The SFPUC must secure an additional average annual water supply of 3.5 mgd to meet the shortfall resulting from instream flow requirements for San Mateo Creek. This 3.5 mgd shortfall is based on the assumption that the Alameda Creek Recapture Project will replace 9.3 mgd of supply lost to Alameda Creek fishery flows. While this shortfall may not pose an immediate threat to reliability, additional supplies will be necessary to resolve this shortfall in the long run.

- **What options should the SFPUC consider to make the Cities of San Jose and Santa Clara permanent customers of the RWS?**

  Converting the Cities of San Jose and Santa Clara to permanent, non-interruptible customers would require the SFPUC to secure 9 mgd of additional water supply. Currently, San Jose and Santa Clara are temporary customers with an interruptible status. The SFPUC will continue to meet the two cities' demands up to 9 mgd through 2018, but may issue a conditional five-year notice of termination or reduction in supply to San Jose and Santa Clara if water use by the Wholesale Customers is projected to exceed 184 mgd before June 30, 2018. Development of additional supplies would be necessary to offer San Jose and Santa Clara permanent status.

- **Should the SFPUC revise its current performance objective on rationing in order to increase dry year reliability of the RWS?**

  Recent drought conditions have prompted the SFPUC to revisit its drought year reliability objective. At the beginning of 2014, the SFPUC called on all customers to voluntarily reduce water use by at least 10%. Later in the year, the SFPUC called for mandatory retail water use reductions of outdoor irrigation by 10% and more recently, by 25%. Retail and Wholesale Customers exceeded the system-wide reduction target of 10% in 2014. Per capita consumption was also very low throughout the service area. There is concern that if the drought continues, additional water savings may be difficult to achieve without significant economic impacts.

The WaterMAP will be presented by SFPUC staff to its Commission in the spring of 2016. The discussion resulting from the questions described in the WaterMAP will help guide the water supply planning objectives through 2035. While the WaterMAP is not a water supply program, it presents pertinent information that will help develop the SFPUC's future water supply planning program.

7.7.2 Potential State and Federal Regulations

The SFPUC's operation of the RWS is subject to numerous State and federal agency permits designed to protect drinking water quality and the environment. Some permit requirements have been in place for decades and influence the way that water supply is managed. Requirements for instream flows, for example, may increase the releases or bypass flow from SFPUC facilities. In the Tuolumne River watershed, the SFPUC currently maintains a specific flow release schedule downstream of Hetch Hetchy Reservoir, Cherry Lake, and Lake Eleanor. When the WSIP was analyzed in the PEIR, local system reservoirs had no formal flow release requirements, so no instream flow release and bypass requirements were reflected in the water supply program for the Calaveras Dam Replacement and Lower Crystal Springs Dam Improvements Projects. However, as noted earlier, unforeseen changes to the flow schedules for Alameda and San Mateo Creeks may impact the water supply reliability of the RWS once all of the WSIP projects have been completed.

Additionally, ongoing and future regulatory proceedings may impact water supplies in ways and amounts that currently remain unknown. Additional instream flow release or bypass requirements may also be triggered by the development of new projects or modifications to existing facilities. For example, as described in **Section 3.1.4**, the SFPUC uses a portion of Don Pedro Reservoir as a water bank under agreement with the Districts. The Federal Energy Regulatory Commission (FERC) re-licensing of the Don Pedro Reservoir Project may require additional water releases from Don Pedro for the preservation of aquatic species in the lower Tuolumne River, potentially affecting the yield of the RWS by reducing the balance of water stored in the water bank.

This page intentionally left blank.

SECTION 8: WATER SHORTAGE CONTINGENCY PLANNING

This section presents water shortage contingency plans, referred to by the SFPUC as Water Shortage Allocation Plans, and includes the following information:

- SFPUC's response to past water shortage experiences and the current drought;
- Procedures for allocating reduced deliveries from the RWS between wholesale and retail customers;
- Retail plan for responding to water shortages; and
- Emergency procedures in response to a catastrophic supply interruption.

8.1 PAST EXPERIENCE WITH WATER SHORTAGES

Every water system has vulnerabilities in terms of its ability to provide a safe and reliable supply of water. Water shortages can occur in a number of ways. Very localized shortages can occur due to distribution system problems, and system shortages can occur due to major facility failures. Yet, beyond system facility contingencies, there exists the potential vulnerability to drought, which limits the amount of water that is available over a series of years. This latter type of contingency is not necessarily caused by physical facility limitations. Within the past 30 years, San Francisco has experienced both localized shortages due to earthquakes and system-wide shortages due to drought.

The SFPUC's past experiences with water shortages, due to drought and earthquakes, have helped shape its current plans and policies relative to water shortage preparedness and response:

- In 1987-92 San Francisco experienced a serious drought. This 6-year drought provides an example of how various stages of action were taken in times when the operational capabilities of Hetch Hetchy and other water supplies available to the SFPUC were taxed to a point that forced drastic actions to avoid running out of water.

- Following the October 17, 1989 Loma Prieta earthquake, the SFPUC worked with the Mayor's Office of Emergency Response to reconnect service to those who were impacted by the earthquake. Most of the homes that lost water service were reconnected to the water system's lines within 72 hours.

- In April 2007, below normal precipitation and snow pack caused the SFPUC to initiate a 10% voluntary reduction in water use in the service area. The call for a voluntary reduction continued through 2009.

The 1987-92 drought illustrated the deficit between the SFPUC's supplies and its customers' demands. Other than the 1976-77 drought, drought sequences in the past did not seriously affect the ability of the SFPUC to maintain full deliveries to its customers. As the SFPUC progressed into the drought and reservoir storage continued to decline, it became evident that full deliveries could not be sustained without the risk of running out of water before the drought ended. This circumstance became a reality in early 1991 when the Hetch Hetchy Reservoir became so depleted (less than 25,000 AF of storage in a reservoir with over 360,000 AF of capacity) that minimum instream flow releases and anticipated demands required the SFPUC to initiate programs to achieve a 45% reduction in system-wide water deliveries to balance water supplies with deliveries. Fortunately, unexpected runoff provided relief from the severity of that instance of water shortage; however, the drought was far from over. **Appendix K** provides a more detailed summary of San Francisco's 1987-92 drought experience and the actions taken at the time.

8.2 EXPERIENCE WITH THE CURRENT DROUGHT

The State is currently in the fourth year of a severe drought, one that is said to be the driest in the hydrologic record. The unprecedented dry weather conditions prompted Governor Jerry Brown to declare a drought State of Emergency in January 2014, which is still in effect to date. This action spurred the SFPUC to request that all customers of the RWS voluntarily reduce water use by at least 10%. Soon after, the San Francisco Mayor's Office issued a formal executive directive requiring that all City departments develop individual water conservation plans and take immediate steps to achieve a mandatory 10% reduction in their water consumption.

In July 2014, new emergency conservation regulations issued by the SWRCB prompted the SFPUC to implement outdoor water waste restrictions and require a mandatory 10% reduction in outdoor water use. Additional emergency conservation regulations issued by the SWRCB in the spring of 2015 established more Statewide water use restrictions, a mandatory Statewide water reduction of 25% compared to 2013 water use, and conservation standards for individual urban water suppliers to meet the Statewide 25% reduction. Per these regulations, the SFPUC retail service area was assigned a conservation standard of 8% in recognition of its low residential per capita water use. In the wholesale service area, conservation standards assigned to the Wholesale Customers range from 8% to 36%. The conservation standards took effect in June 2015 and remains in effect. These emergency conservation regulations were the first of their kind, indicative of the State's desire for swift and substantial action to cope with the drought.

In addition to the State mandates, the SFPUC imposed a mandatory 10% reduction on outdoor irrigation along with water use allocations and excess use charges for all retail irrigation customers starting in August 2014. Following the additional SWRCB regulations in the spring of 2015, the SFPUC increased the mandatory reduction on retail outdoor irrigation from 10% to 25% starting in July 2015. See **Appendix F** for more detailed information about actions taken by the SFPUC during the current drought. In addition, **Sections 8.3.1.4** and **9.2** provide information about the SFPUC's actions to reduce demand during the current drought, including public education and outreach activities and conservation programming.

During the current drought to date, the SFPUC has called for, but has not mandated, a 10% system-wide reduction since January 2014. The SFPUC has not yet been compelled to declare a water shortage emergency and impose subsequent mandatory system-wide rationing and shortage allocations because its customers have exceeded the 10% voluntary system-wide reduction in conjunction with the Statewide mandatory reductions assigned by the SWRCB. If current drought conditions worsen between 2015 and 2018, and the SFPUC determines that system-wide rationing would need to be imposed, then the SFPUC would issue a declaration of a water shortage emergency in accordance with CWC Section 350 and implement rationing in accordance with the WSA and Water Shortage Allocation Plan (WSAP). The WSAP is described in the next section.

To date, retail and wholesale customers have responded positively to State and local mandates. As previously described in **Sections 4.1** and **4.2**, total retail and wholesale demands were in decline and reached historic lows in 2015.

8.3 WATER SHORTAGE ALLOCATION PLAN

Each year during the snowmelt period, the SFPUC evaluates the amount of total water storage expected to occur throughout the RWS. If this evaluation finds the projected total water storage to be less than an identified level sufficient to provide sustained deliveries during drought, the SFPUC may impose delivery reductions or rationing in accordance with (1) the Retail Water Shortage Allocation Plan (RWSAP), which pertains to retail customers and; (2) the Water Shortage Allocation Plan (WSAP) Among Suburban Customers, which pertains to Wholesale Customers. The WSAP provides specific allocations of the available water supply between the retail and

wholesale customers collectively associated with varying system-wide shortages of up to 20%, as shown in **Table 8-1**. More information about the RWSAP and WSAP are provided in the next sections.

As explained in **Section 2.4**, Groveland CSD is accounted for in the retail allocation of RWS supply and is therefore subject to the stages of action and procedures set forth in the RWSAP. However, the corresponding standardized tables in **Appendix B** include RWS supply specific to Groveland CSD, assumed to be equivalent to its demand projection of approximately 0.5 mgd as shown in **Table 4-1**.

Table 8-1. Retail and Wholesale Regional Water System Allocations during System-wide Shortage
[Standardized Table 8-1 Retail: Stages of Water Shortage Contingency Plan]
[Standardized Table 8-1 Wholesale: Stages of Water Shortage Contingency Plan]

Required Level of System-wide Reduction in Water Use	SFPUC Retail Share of Available RWS Supply[a]	Collective Wholesale Customers' Share of Available RWS Supply
5% or less	35.5%	64.5%
6 – 10%	36.0%	64.0%
11 – 15%	37.0%	63.0%
16 – 20%[b]	37.5%	62.5%

a While Groveland CSD is reported in this 2015 UWMP as a wholesale customer, it is considered a retail customer of the SFPUC solely for purposes of allocating RWS supplies between retail customers and Wholesale Customers. Thus, RWS supplies to Groveland CSD are accounted for in the retail supply allocation.

b Allocation procedures per the WSAP do not include RWS shortages above 20%. However, if a shortage of over 20% were to be experienced, the corresponding Tier 1 allocation would follow those set for the 16-20% shortage, with the final individual customer allocations greater than 20% subject to consultation and negotiation between the SFPUC and its Wholesale Customers.

8.3.1 Retail Water Shortage Allocation Plan

Based on the WSAP allocations presented earlier in **Table 8-1**, **Table 8-2** shows RWS supply schedules for retail customers during normal, single dry year, and multiple dry year periods. For the purposes of this analysis, the SFPUC assumed a delivery goal (i.e., ISL) of 265 mgd. System-wide shortages were applied to a demand of 265 mgd and the subsequent allocations between retail customers and Wholesale Customers collectively.

8.3.1.1 Stages of Action

The RWSAP was adopted in 2001[18] to formalize a three-stage program of action to be taken in the retail service area to reduce water use during a drought. In accordance with the RWSAP, prior to the initiation of any water delivery reductions to its retail customers, whether it be initial implementation of reduction delivery or increasing the severity of water shortage, the SFPUC would outline a drought response plan to address the following the water supply situation; proposed water use reduction objectives; alternatives to water use reductions; methods to calculate water use allocations and adjustments; compliance methodology and enforcement measures, and budget considerations.

This drought response plan would be presented at a regularly-scheduled SFPUC Commission meeting for public input. The meeting would be advertised in accordance with the requirements of Section 6066 of the Government Code, and the public would be invited to comment on the SFPUC's intent to reduce deliveries.

Depending on the level of water demand and the desired objective for water use reduction, one, two or all three stages of the RWSAP may be required. **Table 8-3** identifies the water shortage stages of action. Additional information is provided in the RWSAP in **Appendix L**.

[18] SFPUC Resolution No. 01-0245 is provided in **Appendix M**

Table 8-2. Retail Regional Water System Allocations in Normal, Dry, and Multiply Dry Years

[Standardized Table 7-1 Retail: Bases of Water Year Data]

	Normal Year		Single Dry Year[b]		Multiple Dry Years					
					Year 1[b]		Year 2[c]		Year 3[c]	
Year[a]	mgd	%	mgd	%	mgd	%	mgd	%	mgd	%
2015	81.0	100.0	81.0	100.0	81.0	100.0	77.5	95.7	77.5	95.7
2020	81.0	100.0	81.0	100.0	81.0	100.0	79.5	98.1	79.5	98.1
2025	81.0	100.0	81.0	100.0	81.0	100.0	79.5	98.1	79.5	98.1
2030	81.0	100.0	81.0	100.0	81.0	100.0	79.5	98.1	79.5	98.1
2035	81.0	100.0	81.0	100.0	81.0	100.0	79.5	98.1	79.5	98.1
2040	81.0	100.0	81.0	100.0	81.0	100.0	79.5	98.1	79.5	98.1

Normal, single dry, and multiple dry year conditions are on a water year basis. Dry year availability is presented in terms of percentage of normal year availability.

While Groveland CSD is reported in this 2015 UWMP as a wholesale customer, it is considered a retail customer of the SFPUC solely for purposes of allocating RWS supplies between retail customers and Wholesale Customers. Thus, RWS supplies to Groveland CSD are accounted for in the retail supply allocation shown above.

a RWS supply allocations for 2015 reflect current WSIP conditions (i.e., not yet fully complete). RWS supply allocations for projected years 2020 through 2040 reflect full completion of WSIP.

b Single dry year and multiple dry year 1 reflect a system-wide shortage of 10%. Under the WSAP, retail supply allocation at this stage of shortage is 36.0% of available RWS supply, or 85.9 mgd. However, due to the Phased WSIP Variant, only 81 mgd of RWS supply can be delivered, and is therefore shown above.

c Multiple dry years 2 and 3 reflect a system-wide shortage of 20% (or 22% for 2015). For this analysis, a 20% (or 22% for 2015) shortage is considered equivalent to Stage 4, 16-20% system-wide shortage. Under the WSAP, retail supply allocation at this stage of shortage is 37.5% of available RWS supply, or 79.5 mgd (or 77.5 mgd for 2015).

Table 8-3. Retail Water Shortage Stages of Action

[Standardized Table 8-3 Retail: Stages of WSCP – Consumption Reduction Methods]

Water Shortage Stage	Actions by SFPUC	Trigger Point (System-wide Shortage)	Target Water Use Reduction
1 – Voluntary	• Request voluntary rationing of customers • Alert customers to water supply conditions • Remind customers of existing water use prohibitions • Customers are alerted to water supply conditions • Increase education on, and possibly accelerate, incentive programs (e.g., toilet rebates)	10 – 20%	5 – 10%
2 – Mandatory	• Implement all Stage 1 actions • Assign all customers an "allotment" of water based on the Inside/Outside allocation method (based on base year water usages for each account) • Subject water use above the "allocation" level to excess use charges, installation of flow restrictor devices, and shut-off of water	21 – 50%	11 – 20%
3 – Mandatory	• Implement all Stage 2 actions with further reduced allocations	> 50 %	> 20 %

8.3.1.2 Prohibitions on End Uses

Table 8-4 summarizes potential prohibitions that may be enforced during a drought, as well as permanent restrictions established in the SFPUC Rules and Regulations Governing Water Service to Customers.[19] **Appendix K** describes various measures employed during the 1987-92 drought in an attempt to achieve a 45% reduction in retail demands (as applied to the pre-drought demand). These measures included absolute limitations on water use based on residential customer classification and a proportion of historical use within the non-residential sectors. Although not anticipated to be required in the near-term, the SFPUC would employ similar procedures to accommodate system-wide water shortages in excess of 20%, if necessary.

The RWSAP identifies additional water waste prohibitions that may be imposed by the SFPUC as it deems necessary. These prohibitions could potentially be imposed during any stage of water shortage, but would be temporary for the duration of the water shortage. These potential prohibitions are included below. More information about these prohibitions is provided in **Appendix L**.

Among the emergency conservation regulations adopted by the SWRCB during the current drought, urban water suppliers were required to impose specific mandatory restrictions on outdoor irrigation as well as prohibitions on water use by businesses. For the water use restrictions that were not already addressed by the SFPUC Rules and Regulations Governing Water Service to Customers, the SFPUC took action to adopt the restrictions. These mandatory restrictions are included below. More information about these restrictions is provided in **Appendix F**.

8.3.1.3 Penalties, Charges, and Other Enforcement of Prohibitions

The SFPUC has found that the most effective method for minimizing water waste has been through outreach, communication, and responding to water waste reports through the City's 311 service request system. The SFPUC reviews reports of potential water waste and violation of prohibitions submitted through 311. If the report contains sufficient information and reflects a restricted water use, the SFPUC issues a written notice to the water account holder, property owner, and occupant. If reports of waste continue, the SFPUC will call or visit the site to try to verify waste. If water waste is verified and continues, the SFPUC will issue additional warning letters to the account holder. Account holders that receive multiple warnings of verified water waste may be subject to additional action. For a separate description of excess use charges, see **Section 8.3.1.4**.

In addition, the water use restrictions and prohibitions listed above may be enforced using the following means:

- Per the SFPUC Rules and Regulations Governing Water Service to Customers and rate schedule, violation of any water use restriction may result in the installation of a flow-restricting device in the service line of the customer, and continued violation could result in termination of service. The customer bears the cost of any enforcement action.

- Per the SFPUC Rules and Regulations Governing Water Service to Customers, violation of water waste prevention for landscaped areas[20] is subject to a written warning, followed by possible termination of service and penalties per Chapter 100 of the San Francisco Administrative Code if the violation is not corrected.

- As part of the SWRCB emergency conservation regulations, the CWC was amended to identify violations of water use prohibitions as infractions, and therefore punishable by a fine of up to $500 for each day in which the violation occurs.

---

[19] The SFPUC Rules and Regulations Governing Water Service to Customers may be accessed at. www.sfwater.org/index.aspx?page=[illegible]2
[20] SFPUC Rules and Regulations Governing Water Service to Customers, Section F, Rule 16.

Table 8-4. Water Use Restrictions

[Standardized Table 8-2 Retail Only: Restrictions and Prohibitions on End Uses]

Mandatory Restrictions	Applicable Water Shortage Stage(s)
Permanent[a]	
Water waste, including but not limited to, any flooding or runoff into the street, sidewalk or gutter	Not applicable
Using hoses for any purpose without a positive shut-off valve	Not applicable
Serving water at a restaurant, café, or food counter without waiting for a request by a customer or customers	Not applicable
Potable water was not to be used to clean, fill or maintain levels in decorative fountains	Not applicable
Use of potable water for consolidation of backfill, dust control or other nonessential construction purposes if groundwater or recycled water is available and approved by the San Francisco Department of Public Health[b]	Not applicable
Use of single-pass cooling systems, fountains, and commercial car washes	Not applicable
Temporary (i.e., imposed during water shortage)	
Washing sidewalks, driveways, plazas and other outdoor hardscapes for reasons other than health and safety needs[c]	2, 3
Outdoor irrigation of ornamental landscapes or turf with potable water that is not reduced by at least the amount (percentage) specified in the drought response plan	2, 3
Watering outdoor landscapes with potable water during and within 48 hours after a rain event[c]	2, 3
Not providing guests the option to refuse daily laundering of towels and linens at hotels and motels, and not prominently displaying notice of this option in each guestroom[c]	2, 3
Irrigation with potable water of ornamental turf on public street medians[c]	2, 3
Use of additional water for new landscaping or expansion of existing facilities unless low water use landscaping designs and irrigation systems are employed[d]	2, 3
Water service connections for new construction not incorporating water-saving fixtures or devices into the plumbing system[d]	2, 3
Verified water waste as determined by the Water Department would serve as prima facie evidence that the allocation assigned to the water account is excessive; therefore, the allocation was subject to review and possible reduction, including termination of service[d]	2, 3
Use of supplies other than groundwater and/or recycled water for irrigation of golf courses, median strips, and similar turf areas[d]	2, 3
Use of potable water on golf courses outside irrigation of putting greens[d]	2, 3
Use of potable water for street sweepers/washers[d]	2, 3
The washing of all automobiles, motorcycles, RVS, trucks, transit vehicles, trailers, boats, trains, and airplanes outside of a commercial washing facility; unless required to clean windows on all vehicles and such commercial or safety vehicles for health and safety reasons[d]	2, 3
The filling of new swimming pools, spas, hot tubs, or the draining and refilling of existing pools, etc.[d]	2, 3

a Established in SFPUC Rules and Regulations Governing Water Service to Customers, Section E, Rule 12.

b Consistent with the Soil Compaction and Dust Control Ordinance, Ordinance 175-91 (San Francisco Public Works Code, Article 21, Sections 1100-1107).

c Imposed by the SFPUC per emergency conservation regulations adopted by the SWRCB in 2014 and 2015.

d Prescribed in the 1987-92 drought and/or specified in RWSAP; may be enforced during a future drought.

8.3.1.4 Consumption Reduction Methods

The following methods are employed or offered by the SFPUC to help reduce consumption in the retail service area. All of these methods, except for one, are implemented on a continuous basis or as needed, regardless of water shortage. Many of these methods are also demand management measures (DMMs) that are currently implemented. Some of these methods, though not formally enacted in the event of a shortage, are employed at the discretion of the SFPUC's operations (e.g., decrease in pipe flushing). Other methods may have an increase in application, participation, or frequency as a result of a shortage (e.g., public outreach, rebates, Water Wise Evaluations), but the increase is not necessarily triggered by a stage of shortage. The only method that is solely implemented in response to a shortage is mandatory rationing with corresponding allocations and excess use charges, as previously shown in **Table 8-3.**

- **Expand Public Information Campaign:** Through its conservation program, the SFPUC develops media campaigns and extensive informational materials, and performs widespread outreach activities to inform the public of a drought, relay information about water use reductions and prohibitions, and to promote conservation and use of SFPUC's conservation services. The SFPUC regularly notifies top residential and commercial water users of their consumption and SFPUC's services. During the current drought, high-water use letters were sent regularly to irrigation customers. See **Section 9.2.4** for more information about the DMM related to public education and outreach.

- **Improve Customer Billing:** In conjunction with deployment of its Automated Water Meter Program, the SFPUC launched a new bill management system and web portal called My Account in May 2014. This new system allows customers to view their daily water use data provided by the automated water meter reading system. The SFPUC is also planning to implement fractional billing so that customers, instead of being billed on a 1 unit (i.e., 1 CCF) basis, are billed for each 0.01 unit (i.e., 1 cubic foot) consumed. More information about My Account is provided in **Section 9.2.2** and in **Appendix F**. More information about fractional billing is provided in **Appendix F**. Additionally, transition of the billing system from bi-monthly to monthly billing for all customers was completed in July 2013.

- **Increase Frequency of Meter Reading:** In the spring of 2010, the SFPUC began deployment of the Automated Water Meter Program to upgrade all in-City retail water meters with wireless advanced metering technology. This program is described in more detail in **Section 9.2.2**.

- **Offer Water Use Surveys:** The SFPUC provides free Water Wise Evaluations for homes and businesses through its conservation program. Interest and participation in this service tends to increase during times of drought. See **Section 9.2.6** for more information about the DMM related to the conservation program

- **Provide Rebates or Giveaways of Plumbing Fixtures and Devices:** Through its conservation program, the SFPUC provides free conservation fixtures and devices to San Francisco residents. As previously shown in **Table 8-3** incentive programs may be accelerated during a Stage 1 water shortage. During the current drought, the SFPUC expanded its device giveaway program by increasing fixture inventories, and making more fixtures available at its customer service center. Free devices include showerheads, faucet aerators, toilet leak detection tablets and standard repair parts, flow-measuring bags, pre-rinse spray valves, plumbing repair handbooks, "Brown is the New Green" landscape signage, and other items. Also, the SFPUC increased rebate amounts for flushometer toilets, urinals, and commercial-style clothes washers starting in July 2014. See **Section 9.2.6** for more information about the DMM related to the conservation program, and **Section 9.2.7** for a description of free fixtures and devices available to customers.

- **Provide Rebates for Landscape Irrigation Efficiency or Turf Replacement:** The SFPUC's Large Landscape Grant Program offers grants for large landscape irrigation efficiency improvements. During the current drought, the program also promotes the State's Save Our Water turf replacement rebate program. As previously shown in **Table 8-3**, incentive programs may be accelerated during a Stage 1 water shortage. See **Section 9.2.6** for more information about the DMM related to the conservation program.

- **Decrease Line Flushing:** Pipeline and other system flushing may be decreased at the discretion of the SFPUC's operations management. Due to the drought, starting in January 2014, the SFPUC reduced programmatic flushing of dead ends within the in-City distribution system pipelines from a scheduled program to an as-needed basis to respond to water quality issues. Also, as described in **Section 4.1.3**, regular system maintenance flushing in the Town of Sunol has been reduced to an as-needed basis during the current drought. While this method may be employed during a drought, it is not formally triggered by a water shortage stage.

- **Reduce System Water Loss:** The SFPUC conducts pressure management, collects main break data, and administers a Linear Assets Program to help control system losses. See **Section 9.2.5** for more information about the DMM related to management of system losses. For this 2015 UWMP update, a water audit was performed on the in-City distribution system; draft results are provided in **Appendix G**. In addition, to address water loss at the customer level, a Leak Detection Program was launched in April 2015 to notify single family residential customers about potential plumbing leaks that may be occurring at their homes (see **Section 9.2.2**). This program also meets State mandates requiring water suppliers to notify customers when they are aware of leaks that are within the customer's control.

- **Increase Water Waste Patrols:** SFPUC field inspectors watch for, report, and respond to potential water waste they may encounter as part of their regular travel throughout the City, and the SFPUC also encourages the general public to report potential water waste through the City's 311 service request system, as described in **Section 8.3.1.3**.

- **Implement or Modify Drought Rate Structure or Surcharge:** Mandatory rationing is imposed on all customers during a Stage 2 or 3 of water shortage. The RWSAP describes the process for allocating water to customers and levying excess use charges (see **Appendix L**). Continuous excess use is subject to installation of flow restrictors, and/or shut-off of water. As part of the 2015-2016 Drought Program and in line with State mandates to reduce outdoor water use, the SFPUC imposed mandatory rationing only on dedicated irrigation customers. Monthly water use allocations were assigned to approximately 1,600 dedicated irrigation accounts in the retail service area. For each account that exceeded its allocation during the course of the restriction period, a one-time excess use charge was applied to its bill at the end of the restriction period. The excess use charge was equivalent to 100% of the applicable water rate for each unit of excess water used. More information about this mandatory irrigation allocation program is provided in **Appendix G**.

- **Recycled Water Truck-Fill Station:** As noted in **Section 6.2.2.5**, the SFPUC operates a recycled water truck-fill station at its Southeast WPCP, which offsets the use of potable water. In response to increased interest in the station during the current drought, the SFPUC constructed an automated fill station in 2014. Informational and permitting materials were also updated to clarify what uses are permitted, and how to appropriately handle and use recycled water.

8.3.2 Wholesale Water Shortage Allocation Plan

The SFPUC's response to water shortages included the adoption of new agreements regarding how water would be allocated in future drought periods. In connection with the 2009 adoption of the WSA, the Wholesale Customers and San Francisco adopted the WSAP, based on the Interim Water Shortage Allocation Plan adopted in 2000[21], which outlines procedures for allocating water from the RWS to retail customers and Wholesale Customers during system-wide shortages of 20% or less. These procedures are referred to as the Tier 1 Plan and are provided in **Appendix N**. Furthermore, Section 3.11.C of the WSA authorizes the Wholesale Customers to adopt a methodology for allocating the collective wholesale allocation among the individual Wholesale Customers. This methodology is referred to as the Tier 2 Drought Implementation Plan, or DRIP, and is described further in **Section 8.3.2.1**.

For shortages in excess of 20%, the SFPUC will meet with the Wholesale Customers to determine if modifications to the Tier 1 Plan can be agreed upon by the SFPUC and the Wholesale Customers. If they cannot agree, the SFPUC may allocate water at its discretion, subject to challenge by the Wholesale Customers, unless all of the Wholesale Customers direct that a particular Tier 2 allocation methodology be used.

Based on the WSAP allocations presented earlier in **Table 8-1**, **Table 8-5** shows RWS supply schedules for collective wholesale customers during normal, single dry year, and multiple dry year periods. For the purposes of this analysis, the SFPUC assumed a delivery goal (i.e., ISL) of 265 mgd. System-wide shortages were applied to a demand of 265 mgd and the subsequent allocations between retail customers and Wholesale Customers collectively.

In addition to providing an allocation method, the WSAP also includes provisions for transfers, banking, and excess use charges. See **Appendix K** for the full WSAP.

8.3.2.1 Tier 2 Drought Implementation Plan (DRIP)

As described above, Section 3.11.C of the WSA authorizes the Wholesale Customers to adopt a methodology for allocating the collective wholesale allocation among the individual Wholesale Customers. The Tier 2 Drought Implementation Plan (DRIP) was adopted by the Wholesale Customers. The allocation included in the DRIP is based on a formula that takes two primary factors into account: (1) each BAWSCA Wholesale Customer's Supply Assurance from SFPUC, with certain exceptions, and (2) each BAWSCA Wholesale Customer's purchases from SFPUC during the three years preceding adoption of the DRIP.

8.3.2.2 Stages of Action

Water shortage stages applicable to the Wholesale Customers are shown in **Table 8-1**.

[21] SFPUC Resolution No. 00-0244 is provided in **Appendix M**

Table 8-5. Wholesale Regional Water System Allocations in Normal, Dry, and Multiply Dry Years
[Standardized Table 7-1 Wholesale: Bases of Water Year Data]

	Normal Year		Single Dry Year[a]		Multiple Dry Years					
					Year 1[a]		Year 2[b]		Year 3[b]	
Year	mgd	%	mgd	%	mgd	%	mgd	%	mgd	%
2015	184.0	100.0	152.6	82.9	152.6	82.9	129.2	70.2	129.2	70.2
2020	184.0	100.0	152.6	82.9	152.6	82.9	132.5	72.0	132.5	72.0
2025	184.0	100.0	152.6	82.9	152.6	82.9	132.5	72.0	132.5	72.0
2030	184.0	100.0	152.6	82.9	152.6	82.9	132.5	72.0	132.5	72.0
2035	184.0	100.0	152.6	82.9	152.6	82.9	132.5	72.0	132.5	72.0
2040	184.0	100.0	152.6	82.9	152.6	82.9	132.5	72.0	132.5	72.0

Normal, single dry, and multiple dry year conditions are on a water year basis. Dry year availability is presented in terms of percentage of normal year availability.

While Groveland CSD is reported in this 2015 UWMP as a wholesale customer, it is considered a retail customer of the SFPUC solely for purposes of allocating RWS supplies between retail customers and Wholesale Customers. Thus, RWS supplies to Groveland CSD are accounted for in the retail supply allocation shown in **Table 8-2**.

a RWS supply allocations for 2015 reflects current WSIP conditions (i.e., not yet fully complete). RWS supply allocations for projected years 2020 through 2040 reflect full completion of WSIP.

b Single dry year and multiple dry year 1 reflect a system-wide shortage of 10%. Under the WSAP, wholesale supply allocation at this stage of shortage is 64.0% of available RWS supply, or 152.6 mgd.

c Multiple dry years 2 and 3 reflect a system-wide shortage of 20% (or 22% for 2015). For this analysis, a 20% (or 22% for 2015) shortage is considered equivalent to Stage 4, 16-20% system-wide shortage. Under the WSAP, wholesale supply allocation at this stage of shortage is 62.5% of available RWS supply, or 132.5 mgd (or 129.2 mgd for 2015).

8.3.3 Mechanisms to Determine Reductions in Water Use

Actual water savings are tracked through monthly consumption reports that are generated from the customer billing system. These consumption reports are highly accurate as all retail and wholesale customers are metered. Based on a comparison between monthly consumption data, the SFPUC is able to determine reductions in water use for both retail and wholesale customers.

8.3.4 Revenue and Expenditure Impacts During Water Shortages

If the SFPUC declares a water shortage emergency under CWC Section 350 and implements the WSAP, the SFPUC may raise water rates independently of coordination with the annual budget process to make up for lost revenue due to reduced water use (WSA Section 6.03C). The SFPUC also maintains an unappropriated fund balance that can be used to offset the effects of revenue shortfalls caused by drought.

8.4 PREPARATION FOR CATASTROPHIC SUPPLY INTERRUPTION

The SFPUC maintains various planning documents which collectively address its emergency preparedness and planned response in case of a catastrophic interruption of water supplies due to power outages, earthquakes or other disasters. Additionally, the WSIP, previously discussed in **Section 6.1.2**, includes capital projects related to seismic reliability and overall system reliability.

8.4.1 Emergency Preparedness Plans

Following the 1989 Loma Prieta Earthquake, the SFPUC created a departmental Emergency Operations Plan (EOP). The SFPUC EOP was originally released in 1992, and has been updated as necessary ever since, most recently in September 2012. The SFPUC EOP addresses a broad range of potential emergency situations that may affect the SFPUC and supplements the City's Emergency Response Plan (formerly known as the City's EOP), which was prepared by the Department of Emergency Management and most recently updated in 2010. Specifically, the purpose of the SFPUC EOP is to describe its emergency management organization, roles and responsibilities, and emergency policies and procedures.

In addition, SFPUC divisions and bureaus have their own EOPs (in alignment with the SFPUC EOP), which detail that entity's specific emergency management organization, roles and responsibilities, and emergency policies and procedures. The SFPUC tests its EOPs on a regular basis by conducting emergency exercises. Through these exercises, the SFPUC learns how well the plans and procedures will or will not work in response to an emergency. EOP improvements are based on the results of these exercises and real-world event response and evaluation. The SFPUC also has an emergency response training plan that is based on federal, State, and local standards and exercise and incident improvement plans. SFPUC employees have emergency training requirements that are based on their emergency response roles.

8.4.2 Emergency Drinking Water Planning

In February 2005, the SFPUC published the City Emergency Drinking Water Alternatives report. The purpose of this project was to develop a plan for supplying emergency drinking water in the City after damage and/or contamination of the SFPUC raw and/or treated water systems resulting from a major disaster. Since the publication of this report, the SFPUC has implemented a number of projects to increase its capability to support the provision of emergency drinking water during an emergency. These projects include:

- Completion of many WSIP projects and other capital upgrades to improve security, detection, and communication;
- Public Information and materials for home and business;
- Construction of a disinfection and fill station at the existing San Francisco Zoo well, and obtaining a permit to utilize this well as a standby emergency drinking water source;
- Planned construction of six wells under the San Francisco Groundwater Supply Project, two of which will also serve as emergency drinking water supplies, including a distribution system to fill emergency water tankers;

- Purchase and engineering of emergency-related equipment, including water tanker trucks and water distribution manifolds, to help with distribution post-disaster; and

- Coordination of planning with City departments, neighboring jurisdictions, and other public and private partners to maximize resources and supplies for emergency response.

With respect to emergency response for the RWS, the SFPUC has prepared the RWS Emergency Response and Recovery Plan (ERRP), completed in 2003 and last updated in 2006. The purpose of the ERRP is to describe the RWS emergency management organizations, roles and responsibilities within those organizations, and emergency management procedures. This contingency plan addresses how to respond to and to recover from a major RWS seismic event, or other major disaster. The ERRP complements the other SFPUC emergency operations plans at the department, division, and bureau levels for major system emergencies.

The SFPUC has also prepared the RWS Water Quality Notifications and Communications Plan. This plan, which was first prepared in 1996 and was most recently updated in 2010, provides contact information, procedures, and guidelines to be implemented by several SFPUC divisions, wholesale customers, and BAWSCA. The plan treats water quality issues as potential or actual supply problems, which fall under the emergency response structure of the ERRP.

8.4.3 Power Outage Preparedness and Response

The SFPUC's water transmission system is primarily gravity fed from the Hetch Hetchy Reservoir to the City. Within the in-City distribution system, key pump stations have generators in place and all others have connections in place that would allow portable generators to be used.

Although water conveyance throughout the RWS would not be greatly impacted by power outages because it is gravity fed, the SFPUC has prepared for potential regional power outages as follows:

- The Tesla Treatment Facility, the SVWTP, and the San Antonio Pump Station have back-up power in place in the form of generators or diesel-powered pumps. Additionally, both the SVWTP and San Antonio Pump Station would not be impacted by a failure of the regional power grid because these facilities are powered by hydropower generated by the Hetch Hetchy Water and Power System.

- Both the HTWTP and the Baden Pump Station (part of the Peninsula System) have back-up generators in place.

- Administrative facilities that will act as emergency operation centers also have back-up power.

- The SFPUC has an emergency water supply connection with the SCVWD, the SCVWD intertie, which also has back-up generators in place.

- Additionally, as described in the next section, the WSIP includes projects that expand the SFPUC's ability to remain in operation during power outages and other emergency situations.

8.4.4 Capital Projects for Seismic Reliability and Overall System Reliability

As discussed previously, the SFPUC is also undertaking a WSIP to enhance the ability of the SFPUC water system to meet identified service goals for water quality, seismic reliability, delivery reliability, and water supply.

As illustrated previously, the WSIP projects include several projects located in San Francisco to improve the seismic reliability of the in-City distribution system, including more wells that can be used as emergency drinking water sources. The WSIP also incorporates many projects related to the RWS to address both seismic reliability and overall system reliability. The WSIP is currently at 90% completion.

In addition to the improvements that will come from the WSIP, the City has already constructed system interties for use during catastrophic emergencies, short-term facility maintenance and upgrade activities, and times of water shortages. These interties—the EBMUD-Hayward-SFPUC Intertie, SCVWD Intertie, and South Bay Aquaduct Interties—are described in **Section 7.4.3**.

- A 35 mgd intertie with EBMUD allowing EBMUD to serve the City of Hayward's demand and/or supply the SFPUC directly (and vice versa);
- A 40-mgd system intertie between the SFPUC and SCVWD; and,
- One permanent and one temporary intertie to the South Bay Aqueduct, which would enable the SFPUC to receive State Water Project water.

The WSIP also includes projects related to standby power facilities at various locations. These projects will provide for standby electrical power at six critical facilities to allow these facilities to remain in operation during power outages and other emergency situations. Permanent engine generators will be provided at four locations (San Pedro Valve Lot, Millbrae Facility, Alameda West, and HTWTP), while hookups for portable engine generators will be provided at two locations (San Antonio Reservoir and Calaveras Reservoir).

8.5 MINIMUM SUPPLY FOR NEXT THREE YEARS

The table below projects retail and wholesale supplies for the next three years, assuming the conditions of years 1, 2, and 3 of a multiple dry year event.

Table 8-6. Minimum Supplies for Next Three Years

[Standardized Table 8-4 Retail: Minimum Supply Next Three Years]
[Standardized Table 8-4 Wholesale: Minimum Supply Next Three Years]

Year	2016	2017	2018
Multiple Dry Years	Year 1	Year 2	Year 3
Retail Supplies[a]	83.4	79.9	79.9
Wholesale Supplies[b]	152.9	129.2	129.2

a Retail supplies are comprised of RWS (up to 81 mgd in dry year 1, and up to 77.5 mgd in dry years 2 and 3 of a multiple dry year event assuming a 2015 base year), groundwater (2.2 mgd), and recycled water (0.2 mgd). Near-term projections for non-potable supplies are not available and would be minimal, and are therefore not included in this table. This row includes supplies to Groveland CSD (approximately 0.5 mgd).

b Wholesale supplies are comprised of RWS only. The corresponding standardized table in **Appendix B** includes supplies to Groveland CSD (approximately 0.5 mgd).

This page intentionally left blank.

SECTION 9: DEMAND MANAGEMENT MEASURES

This section describes the SFPUC's efforts to promote conservation and to reduce demand on water supply. Several demand management measures (DMMs)—including metering, public education and outreach, and water conservation program coordination—are addressed.

9.1 COMPLIANCE WITH THE CALIFORNIA URBAN WATER CONSERVATION COUNCIL

The SFPUC is a signatory of the California Urban Water Conservation Council (CUWCC). The conservation programs implemented by the SFPUC are based on the 14 Best Management Practices (BMPs) originally identified by signatories of the CUWCC Memorandum of Understanding Regarding Urban Water Conservation in California (MOU) in 1991. Since then, the CUWCC's 14 BMPs have been updated and re-organized into five categories, offering its signatories more flexible options for meeting BMP requirements. Two categories, Utility Operations and Education, are "Foundational BMPs" considered to be essential water conservation activities by any utility and were adopted for implementation by all signatories to the MOU as ongoing practices with no time limits. The remaining BMPs are "Programmatic BMPs" and are organized into Residential; Commercial, Industrial, and Institutional (CII); and Landscape categories. Reporting on these Programmatic BMPs may be voluntary, depending on the compliance option selected by the utility.

The BMPs describe actions and activities that encourage water conservation and are a result of balanced collaboration between urban water agencies, public interest organizations, and private entities.

Under the MOU, the CUWCC was created and charged with responsibilities and authorities, including but not limited to recommending study methodologies for BMPs, collecting and summarizing information on implementation of BMPs, and submitting annual reports to the SWRCB. Signatories of the MOU are required to submit bi-annual reports to the CUWCC outlining progress toward implementing the BMPs. Compliance with the BMP water savings goals can be accomplished in one of three ways, including (1) accomplishing the specific measures listed in each BMP; (2) accomplishing a set of measures which achieves equal or greater water savings; and (3) accomplishing set water savings goals as measured in gallons per capita per day consumption, referred to as GPCD compliance. The SFPUC has used the GPCD compliance option for the last two reporting cycles. In October 2015, the SFPUC submitted its 2013 and 2014 BMP annual reports for both its retail and wholesale service areas to the CUWCC, and has been verified to be in full compliance with the MOU. See **Appendix O** for coverage reports documenting the SFPUC's compliance.

The DMMs identified in the California Urban Water Management Planning Act are included among the Foundational BMPs of the CUWCC. Implementation of each DMM is described in the following sections based on, but not limited to, information reported to the CUWCC.

9.2 RETAIL DMMS

The SFPUC has been implementing conservation programs for over several decades. Through the SFPUC's longstanding, intensive efforts to promote conservation and educate San Franciscans and its retail customers on efficient and appropriate uses of water, San Francisco has had one of the lowest per capita water uses in the State even before the onset of the current drought and despite continuous economic growth. As stated in **Section 4.1**, gross and residential per capita consumption by in-City retail water customers are 77 and 45 GPCD, respectively. Taking suburban retail use into account, gross and residential per capita consumption by all retail water customers are 82 and 45 GPCD, respectively.

9.2.1 Water Waste Prevention Ordinances

9.2.1.1 Past Implementation

Permanent water use restrictions are established in Section E of the SFPUC Rules and Regulations Governing Water Service to Customers. During the 1987-92 drought, the SFPUC enacted numerous water use restrictions and prohibitions in response to the severe water shortage. With the end of the drought in 1993, the SFPUC elected to continue certain restrictions to promote long-term conservation. These restrictions are also included as part of the RWSAP's water waste prohibitions (see **Section 8.3.1** and **Appendix L**).

Violation of any water use restriction may result in the installation of a flow-restricting device in the service line of the customer, and continued violation could result in termination of service. The customer bears the cost of any enforcement action.

Section F of the SFPUC Rules and Regulations Governing Water Service to Customers, which is implemented as part of the City's Water Efficient Irrigation Ordinance, took effect in 2010 and also prohibits water runoff from landscapes of any size due to by low head drainage, overspray, broken irrigation hardware, or other conditions where water flows onto adjacent property, walks, roadways, parking lots, or other structures.

9.2.1.2 Planned Implementation

The SFPUC will continue to implement the above water use restrictions per its Rules and Regulations Governing Water Service to Customers. While the SWRCB continues to evaluate the severity of the current drought and determines whether or not certain emergency regulations, including mandatory water use restrictions, shall become permanent, the SFPUC is prepared to comply with State mandates.

9.2.2 Metering

9.2.2.1 Past Implementation

All in-City retail customers have been metered since 1916, and are billed by volume. All suburban retail customers are also fully metered and are billed by volume. There are approximately 178,000 existing water meters in the City and approximately 220 in the suburban retail service area.

In the spring of 2010, the SFPUC began deployment of the Automated Water Meter Program to upgrade all in-City and suburban retail water meters with wireless advanced metering technology. The SFPUC is the first major water utility in the State to implement a system of this scale. As of the close of FY 2014-15, deployment was nearly complete at 96%. Full deployment is anticipated by December 2018.

The automated water meter reading system enabled the launch of tools to help monitor customer water use and identify potential high or unusual usage: My Account and the Leak Detection Program. My Account, a new bill management system and web portal, was launched in May 2014 and allows customers to view their daily water use data provided by the automated water meter reading system. The SFPUC also launched a Leak Detection Program in April 2015 to notify single family residential customers about potential plumbing leaks that may be occurring at their homes. Hourly water consumption data collected through the automated water meter reading system are analyzed, and if continuous water use is observed, the SFPUC sends a courtesy postcard to notify the customers of a potential leak.

Existing sub-metering requirements are established in the San Francisco Green Building Code and Section F of the SFPUC Rules and Regulations Governing Water Service to Customers. Per the Green Building Code, new non-residential buildings must install a separate sub-meter for each individual building tenant that would consume

more than 1,000 gallons per day. For new non-residential buildings over 50,000 square feet, a sub-meter must be installed for each tenant that consumes more than 100 gallons per day. Section F of the SFPUC Rules and Regulations Governing Water Service to Customers, which is implemented as part of the Water Efficient Irrigation Ordinance, requires dedicated irrigation meters for landscape areas greater than 5,000 square feet.

9.2.2.2 Planned Implementation

Replacement of the small number of remaining old meters is anticipated by December 2018. The SFPUC is also planning upgrades to My Account and the Leak Detection Program. In 2016, the Leak Detection Program will be expanded to send alerts via e-mail, text, and phone messages and to potentially include small multi-family residential accounts. The SFPUC is also exploring including hourly data in My Account and issuing high or unusual usage alerts for non-residential customers.

9.2.3 Conservation Pricing

9.2.3.1 Past Implementation

For many years, the SFPUC has used conservation pricing as an incentive to conserve water. To promote the installation of efficient plumbing fixtures, the SFPUC implemented an incentive rate structure for its retail customers. Under the five-year rate schedule for FY 2009-10 through FY 2013-14, water rates for both single family and multi-family residential accounts were set with a two-tier increasing block rate structure, where the Tier 1 threshold was 3 CCF. Non-residential (i.e., commercial) water rates were set with a uniform rate structure. Water rates across all customer sectors were scheduled to increase annually.

The rate schedule was revised in May 2014 for FY 2014-15 through FY 2017-18. Both single family residential and multi-family residential rates were maintained as a two-tier increasing block rate structure. While the Tier 1 threshold for multi-family residential accounts stayed at 3 CCF, the Tier 1 threshold for single family residential accounts was increased from 3 to 4 CCF to more accurately represent average water consumption in the single family residential sector. Non-residential water rates were maintained as a uniform rate structure. Water rates across all customer sectors are scheduled to increase annually.

The rate schedule also addresses violation of water use restrictions. Violations may result in the installation of flow-restricting devices, and continued violation may result in discontinuance of water service. The costs of these actions are borne by the customer. These costs have increased under the latest rate schedule.

The SFPUC's current rate schedule, effective for FY 2014-15 through FY 2017-18, may be accessed at: www.sfwater.org/modules/showdocument.aspx?documentid=7743.

9.2.3.2 Planned Implementation

The current rate schedule is in effect through FY 2017-18. The SFPUC conducts an independent rate study every five years to inform the next rate schedule.

9.2.4 Public Education and Outreach

9.2.4.1 Past Implementation

Throughout the year, the SFPUC markets its conservation services and financial incentives through bill inserts and direct mailings, social media, local media and trade publications, and its website. For example, the SFPUC sends letters on an annual basis to the top water users in the single family residential, multi-family residential, and commercial sectors to encourage them to improve efficiency, alert them to the possibility of plumbing leaks, and offer free Water Wise Evaluations. Bill inserts often feature conservation-related articles and water-saving tips.

The SFPUC also participates in numerous community events and presentations that reach residents and businesses, as well as events that target specific audiences and industry trade groups. Water conservation staff, along with education partners, conduct in-class presentations during the school year. Program offerings are aligned with State curriculum standards, and many focus on providing placed-based or outdoor learning opportunities to supplement students' classroom work.

Between 2010 and 2015, over 11,000 top user letters were sent, encouraging customers to reduce use. In the summers of 2014 and 2015, during which mandatory irrigation reductions were in effect, four rounds of letters were sent to approximately 470 irrigation customers. Since launch of the Leak Detection Program in April 2015, approximately 1,200 postcards were sent to single-family residential customers indicating that they have continuous water usage, which may indicate they have a leak. In addition, each customer receives a newsletter with their monthly bill that includes information about conservation, reaching over 170,000 customers each edition. As described in **Section 9.2.2**, the deployment of the Automated Water Meter Program enabled the launch of My Account in May 2014. As of the close of FY 2014-15, over 13,000 customers, or 8% of the retail customer base, have registered for My Account.

For each of the last four years, the SFPUC participated in the USEPA's National Fix-A-Leak week with a local television public service announcement and website to promote plumbing leak awareness and repairs in San Francisco homes. The SFPUC also participated in over 200 local festivals, street fair events, and community presentations over the last five years. The SFPUC has a robust school education program and in the last five years, staff have participated in more than 500 classroom and field trips, reaching thousands of students. The SFPUC also offers a variety of free teacher resources and, in FY 2013-14, sent more than 60,000 multilingual drought awareness fact sheets home to San Francisco Unified School District (SFUSD) families as part of the SFUSD's backpack mail program.

Over the last five years, the SFPUC sponsored the Water Wise and Natural Plant Care demonstration garden in partnership with Garden for the Environment. During this time, the SFPUC also hosted over 50 free workshops at the garden to help San Francisco residents create and maintain beautiful, water-efficient landscapes, and learn about non-potable water supply alternatives, such as graywater and rainwater harvesting.

9.2.4.2 Planned Implementation

The SFPUC's 2015 Retail Water Conservation Plan identifies a number of conservation activities related to public education and outreach that will help the SFPUC continue to meet its conservation goals. The SFPUC anticipates that it will continue to participate in the activities as outlined above, including its school education program and support to the largest water users in each customer sector.

In addition to these continued measures, the SFPUC has also identified a number of new measures for implementation over the next five years. For instance, while the SFPUC currently provides water use updates to customers through its My Account portal for those who sign up and to customers receiving leak alerts, the SFPUC will consider ways to more proactively reach customers who don't participate in these services. The SFPUC may also expand leak alerts through its Leak Detection Program from single-family customers to multi-family buildings and consider high usage alerts for non-residential and larger sites.

9.2.5 Management of System Losses

9.2.5.1 Past Implementation

The SFPUC manages system losses mainly through pressure management. There are currently 24 distinct pressure zones in the system, with the majority being gravity-fed. A hydraulic model is used to monitor both static

and residual pressures, with data inputs coming from SCADA, periodic data from eight to 10 system pressure transducers, and data collected by the San Francisco Fire Department during hydrant testing.

The SFPUC also collects and compiles main break data throughout its system. A study was recently completed to analyze main break data from 2011 to 2015 to determine what types of pipes were statistically prone to failure due to natural causes. A geographical hot-spot analysis was also conducted to identify areas in the City that are especially prone to high occurrences of main breaks.

In addition, the SFPUC's Automated Water Meter Program (described previously in **Section 9.2.2**) and Linear Assets Management Program enable improved management of system losses. The Linear Assets Management Program replaces and renews distribution system pipelines and customer service connections for approximately 1,250 miles of drinking water mains in the City. Planning analysis has demonstrated need to increase annual improvement rate from the previous 6 miles per year to an increased rate of 15 miles per year to minimize main breaks and meet customer LOS goals for uninterrupted service. Improvements include replacement, rehabilitation, re-lining, and cathodic protection of all pipe size categories to extend or renew pipeline useful life.

A renew service program renews assets at the end of their useful life between the water main and the customer's service connection. These assets include 1-inch to 8-inch diameter service pipes made of galvanized steel, lead, and plastic, to be replaced with copper or ductile iron; broken meter boxes; outdated or undersized meters and associated piping; and subsequent associated sidewalk and roadway restoration. No increase in cost over time is anticipated.

9.2.5.2 Planned Implementation

The SFPUC is in the process of developing an updated proactive leak detection program. A similar program was implemented around 2010, but was halted due to inadequate staffing. The initial focus of the program will be on the hot spot areas identified in the 2011 to 2015 main break study.

9.2.6 Water Conservation Program

9.2.6.1 Past Implementation

The SFPUC Water Conservation Section currently has 13 full-time time staff under the direction of the Water Conservation Section Manager. Conservation staff coordinate implementation of various residential, landscape, and CII conservation programs. The SFPUC's current retail water conservation program consists of an extensive mix of measures, including incentives, services, and educational assistance. Incentives include rebates for high-efficiency fixtures, free toilets and installations for qualifying customers, discounts for graywater and rainwater systems, grants for large landscape irrigation efficiency improvements, and free efficient devices. Services include conservation surveys, landscape plan review, and school education programs. The SFPUC also provides a host of tools to help customers understand and manage their water use, including the previously mentioned My Account feature, high use alerts, and a bill adjustment program for leak repair.

Between 2011 and 2014, the SFPUC conducted over 29,000 evaluations; issued over 22,000 high-efficiency toilet (HET) rebates, and over 1,000 high-efficiency urinal rebates; and issued over 15,000 rebates for high-efficiency clothes washers.

In-City retail water demand has continued to decline through 2015 despite population growth, due in large part to conservation efforts. In the recently completed Conservation Plan, it was estimated that, between 2005 and 2015, 9.4 mgd of water savings have been achieved through active and passive conservation efforts. In terms of per

capita water use, gross per capita water use was 95 gallons GPCD and residential per capita water use was 53 GPCD in 2010. In 2015, these figures dropped to 82 GPCD and 45 GPCD, respectively.

9.2.6.2 Planned Implementation

Moving forward, the conservation program will continue to consist of an extensive mix of incentives, services, and tools. Foundational customer assistance measures, including water evaluation surveys, site usage reports and tools, free devices, and public education and outreach will continue to be offered with no definite end date. Fixture incentive measures for toilets, urinals and washers, however, are expected to be phased out by 2020 or earlier because of new legislation and codes, as well as high market saturation rates for toilets, in particular. It is likely that the SFPUC will pursue new measures in the future, but information on these measures is not well enough defined at this time.

The focus of the SFPUC's conservation program over the next five years will be on the greatest water savings opportunities, including:

- Replacing remaining old, inefficient fixtures and equipment, particularly in multi-family dwellings and non-residential facilities;

- Improving the efficiency of irrigation systems and increasing the amount of drought-resistant vegetation in the largest landscaped areas;

- Helping the largest water users in each customers sector understand, monitor, and improve the efficiency of their water use, as feasible; and

- Helping water users across all customer sectors to understand and monitor their water use and to address leaks and water waste in an effort to achieve and maintain efficient water use.

9.2.7 Other DMMs

In addition to the DMMs, the SFPUC also seeks water savings through innovative programs that encourage the use of graywater and rainwater. In 2009, the SFPUC developed and provided a guidance manual for customers on how to design simple graywater systems, and in 2011 launched a laundry-to-landscape pilot program in 2011 for residential customers. In 2015, the SFPUC resumed a rain barrel and cistern discount program and plans to provide a rainwater harvesting guidance manual. The SFPUC also developed stormwater design guidelines and provided technical assistance on swales, rainwater gardens, stormwater planters, green roofs, and permeable pavement that captures rainwater for irrigation and recharge purposes.

Like many other water utilities, the SFPUC provides free conservation fixtures and devices to San Francisco residents during water audits and for pick up at its customer service center, such as 1.5-gallons-per-minute (gpm) showerheads, 0.5-gpm faucet aerators, garden spray nozzles, and toilet replacement parts (e.g., flappers and fill valves). Conservation device giveaways are a simple and cost-effective way to help customers reduce their water use. From 2010 to 2015, the SFPUC estimated that it distributed over 125,000 water-efficient devices to both residential and commercial customers.

Information about additional retail DMMs implemented by the SFPUC may be found in the CUWCC BMP coverage reports (**Appendix O**). More information about the retail water conservation program is available in the Conservation Plan.

9.3 WHOLESALE DMMS

As described in **Section 5.5**, BAWSCA coordinates water conservation programs and services for its member agencies. Under the terms of the WSA, the SFPUC cannot provide direct financial assistance for conservation programs to a single Wholesale Customer. However, the SFPUC's past and planned implementation of wholesale DMMs, to the extent allowed under the WSA, are described below.

9.3.1 Metering

9.3.1.1 Past Implementation

The SFPUC's wholesale customers are fully metered. About 50 of the oldest meters were replaced in 2015. The remaining meters, approximately 160, were last replaced in the 1990s or 2000s, but are kept accurate through a regular preventative maintenance program. SFPUC staff visit all wholesale meters on a monthly basis to record a billing read, visually inspect the meter, and conduct valve maintenance. The SFPUC is currently in the process of developing a crew to continue a yearly meter calibration program which has been on hold due to intensive WSIP activities in recent years. During 2014-2015, approximately 91% of wholesale meters were outfitted with a wireless transmitter so they are able to transmit hourly water consumption through a cellular endpoint that does not require a fixed network infrastructure. The water consumption is analyzed and recorded in advanced metering software, allowing SFPUC and its wholesale customers to view hourly and daily water consumption rather than waiting for a monthly billing meter read. The software also provides custom alerts for issues in the system or unusual consumption patterns, such as leaks.

9.3.1.2 Planned Implementation

To date, deployment of the wholesale advanced metering system is nearly complete. Nearly all of the remaining 9% of wholesale meters will be installed with cellular endpoints when interfering construction projects are completed. Additionally, SFPUC is currently considering using the advanced metering system for automated billing to eliminate the need for monthly field visits to read each wholesale meter.

9.3.2 Public Education and Outreach

The SFPUC provides technical and administrative assistance for public information and school education to its Wholesale Customers as requested. In 2014 and 2015, the SFPUC prepared a regional drought awareness marketing and media campaign that covered some of Wholesale Customers' service areas. In the past, the SFPUC has provided information packets on the SFPUC water system, such as the two-piece map series of the Hetch Hetchy/Peninsula Water Supply System and San Francisco's Water Distribution System to Wholesale Customers for inclusion in their school education programs. In addition, the SFPUC completed a series of comprehensive water demand and conservation potential studies with its Wholesale Customers in 2004 These conservation studies evaluated the cost-effectiveness of 32 conservation measures and the resulting water savings potential for each individual Wholesale Customers. These studies provided informative and educational data for the Wholesale Customers about water conservation measures and associated water savings.

9.3.3 Water Conservation Program Coordination and Staffing Support

As previously described in **Section 5.5**, BAWSCA manages a Regional Water Conservation Program and represents the interests of the Wholesale Customers. The program is composed of several different conservation measures and is designed to support and augment its member agencies' customer efforts to use water more efficiently.

The SFPUC seeks opportunities to work with BAWSCA and its member agencies and other water agencies, including the SCVWD, to leverage available resources on an ongoing basis. The SFPUC's commitment to regional coordination is evident in many of its conservation programs, such as the Bay Area Clothes Washer Rebate Program, which has been ongoing since 2006. In 2007, the SFPUC, BAWSCA, and five other Bay Area water agencies secured $1 million in grant funding for a regional "Water Saving Hero" public education campaign. This campaign provided a consistent message about water supply conditions and long-term challenges, and informed customers across the region via simple and effective water conservation examples. The integrated advertising and marketing program included regional print, transit and radio ads, marketing materials, and a new website. Throughout the campaign, the SFPUC reduced system-wide water usage by more than 13% compared to historic consumption under similar hydrologic conditions.

Under the terms of the WSA with its Wholesale Customers, the SFPUC cannot provide direct financial assistance for conservation programs to an individual Wholesale Customer and add this expense to the wholesale revenue requirement for that year. The SFPUC can provide staff to assist Wholesale Customer conservation efforts and, through agreement with BAWSCA, can develop service area-wide conservation programs that can be funded as a joint expense by its retail customers and Wholesale Customers.

9.3.4 Asset Management

The SFPUC initiated a Pipeline Inspection Program in the early 1990s for the 350 miles of water transmission lines in the RWS. Routine inspections are considered preventive maintenance measures, but they also provide information on pipeline leaks. These inspections are usually conducted year-round with no more than one section of a major pipeline out of service at any time. The Pipeline Inspection Program covers the entire water transmission system over a 20-year period and then repeats. The SFPUC has a goal to inspect one section per quarter (four inspections per year), with each section averaging 4 to 6 miles. Technically, the RWS does not have any distribution system components, only transmission system components. In addition to inspections, SFPUC staff also regularly compare production volumes with customer consumption to help identify the leakage rate.

9.3.4.1 Past Implementation

The major focus of asset management for the wholesale system in the past decade has been the WSIP. To date, the program is at approximately 90% completion. From 2011 to 2015, system improvements ranged from treatment plant expansions, pipeline repair and readiness improvements, to pipeline rehabilitation and new installations. Major pipeline work that was completed in 2011-2015 included replacement of Crystal Springs Pipeline No. 2, and installation of San Andreas Pipeline No. 3 and the Irvington Tunnel. The large pipeline work has increased system capacity which allows for greater flexibility in taking certain pipes offline for longer periods of time to do thorough inspections or other maintenance.

9.3.4.2 Planned Implementation

During implementation of the WSIP, about half of the wholesale system transmission pipelines were replaced. The SFPUC's primary focus for 2016 is on warranty inspections of the newly-installed pipelines to determine if any follow-up work is required before a new installation warranty period is complete. The other half of transmission lines that were not replaced under the WSIP are subject to a prioritization program based on material type and age. The program is informed by ongoing inspections to determine when pipelines need to be replaced. SFPUC staff meet weekly to carefully coordinate and prioritize system maintenance, inspections, and replacements.

9.3.5 Assistance to Wholesale Customers

As previously stated, under the terms of the WSA with its Wholesale Customers, the SFPUC cannot provide direct financial assistance for conservation programs to an individual Wholesale Customer and subsequently adds this expense to the wholesale revenue requirement for that year. The SFPUC can provide staff to assist Wholesale Customer conservation efforts and, through agreement with BAWSCA, can develop service area-wide conservation programs that can be funded as a joint expense by its retail customers and Wholesale Customers. Refer to **Section 9.3.2** for information on the SFPUC's collaborative efforts with BAWSCA on public education and outreach efforts.

This page intentionally left blank.

SECTION 10: PLAN ADOPTION AND UWMP CHECKLIST

This section describes the adoption, submittal, and implementation of this 2015 UWMP A checklist is also provided to facilitate DWR's review of the 2015 UWMP.

10.1 PLAN ADOPTION, SUBMITTAL, AND IMPLEMENTATION

The SFPUC prepared this 2015 UWMP update and will present it to the SFPUC Commission for adoption on May 24, 2016. A copy of the SFPUC resolution adopting this 2015 UWMP update will be provided in **Appendix P**

Within 30 days of SFPUC Commission approval, the adopted 2015 UWMP will be submitted electronically to the DWR via its Water Use Efficiency data online submittal tool (WUEdata). Electronic copies on compact discs will also be provided to the California State Library and to cities and counties within which the SFPUC provides water In addition, throughout this 30-day period, the SFPUC will make this adopted 2015 UWMP available for public review during normal business hours. The SFPUC will implement this adopted 2015 UWMP in accordance with the California Urban Water Management Planning Act.

Following adoption, the SFPUC will continue to implement water supply planning programs and projects identified in this 2015 UWMP, including those related to conservation, groundwater, and recycled water. Many of these projects are reflected in the WSIP adopted in 2008, which details project implementation schedules and budgets. The WSIP is described in **Section 6.1.2**.

10.2 UWMP CHECKLIST

The following checklist is provided to facilitate DWR's review of the completeness of this document, and is organized by subject matter. In addition, complete sets of standardized tables and SB X7-7 Verification Form tables prescribed by DWR are provided in **Appendices B** and **D**, respectively.

Table 10-1. UWMP Checklist

California Water Code Section	UWMP Requirement	UWMP Location	
		Retail	Wholesale
Plan Preparation			
10620(b)	Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.	Section 10.1	Section 10 1
10620(d)(2)	Coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.	Section 2.3.1 and Appendix C	Section 2 3 1 and Appendix C
10642	Provide supporting documentation that the water supplier has encouraged active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan.	Appendix C	Appendix C
System Description			
10631(a)	Describe the water supplier service area.	Section 3 2	Section 3 3
10631(a)	Describe the climate of the service area of the supplier.	Section 3 2 1	Section 3.3 1

Table 10-1 (continued)

California Water Code Section	UWMP Requirement	UWMP Location	
		Retail	Wholesale
10631(a)	Provide population projections for 2020, 2025, 2030, and 2035.	Table 3-3	Table 3-4
10631(a)	Describe other demographic factors affecting the supplier's water management planning.	Section 3.2.2	Section 3.3.2
System Description and Baselines and Targets			
10631(a)	Indicate the current population of the service area.	Table 3-3 and Table 5-1	Table 3-4
System Water Use			
10631(e)(1)	Quantify past, current, and projected water use, identifying the uses among water use sectors.	Section 4.1	Section 4.2
10631(e)(3)(A)	Report the distribution system water loss for the most recent 12-month period available.	Section 4.1.3	Section 4.2.3
10631.1(a)	Include projected water use needed for lower income housing projected in the service area of the supplier.	Section 4.1.4	Not applicable
Baselines and Targets			
10608.20(b)	Retail suppliers shall adopt a 2020 water use target using one of four methods.	Section 5.2	Not applicable
10608.20(e)	Retail suppliers shall provide baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along with the bases for determining those estimates, including references to supporting data.	Section 5.1 and Appendix D	Not applicable
10608.22	Retail suppliers' per capita daily water use reduction shall be no less than 5% of base daily per capita water use of the 5 year baseline. This does not apply is the suppliers base GPCD is at or below 100.	Section 5.3	Not applicable
10608.24(a)	Retail suppliers shall meet their interim target by December 31, 2015.	Section 5.4	Not applicable
1608.24(d)(2)	If the retail supplier adjusts its compliance GPCD using weather normalization, economic adjustment, or extraordinary events, it shall provide the basis for, and data supporting the adjustment.	Not applicable	Not applicable
10608.36	Wholesale suppliers shall include an assessment of present and proposed future measures, programs, and policies to help their retail water suppliers achieve targeted water use reductions	Not applicable	Section 5.5
10608.40	Retail suppliers shall report on their progress in meeting their water use targets. The data shall be reported using a standardized form.	Appendix D	Not applicable
System Supplies			
10631(b)	Identify and quantify the existing and planned sources of water available for 2015, 2020, 2025, 2030, and 2035.	Table 6-3 and Table 6-7	Table 6-3
10631(b)	Indicate whether groundwater is an existing or planned source of water available to the supplier.	Section 6.2.1.1	Not applicable

Table 10-1 (continued)

California Water Code Section	UWMP Requirement	UWMP Location	
		Retail	Wholesale
10631(b)(1)	Indicate whether a groundwater management plan has been adopted by the water supplier or if there is any other specific authorization for groundwater management. Include a copy of the plan or authorization.	Section 6.2.1.1	Not applicable
10631(b)(2)	Describe the groundwater basin.	Sections 6.2.1.1 and 6.2.3.1	Not applicable
10631(b)(2)	Indicate if the basin has been adjudicated and include a copy of the court order or decree and a description of the amount of water the supplier has the legal right to pump.	Section 6.2.1.1	Not applicable
10631(b)(2)	For unadjudicated basins, indicate whether or not the department has identified the basin as overdrafted, or projected to become overdrafted. Describe efforts by the supplier to eliminate the long-term overdraft condition.	Section 6.2.1.1	Not applicable
10631(b)(3)	Provide a detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years.	Section 6.2.1.1 and Table 6-4	Not applicable
10631(b)(4)	Provide a detailed description and analysis of the amount and location of groundwater that is projected to be pumped.	Section 6.2.2.1 and Table 6-7	Not applicable
10631(d)	Describe the opportunities for exchanges or transfers of water on a short-term or long- term basis.	Sections 7.2.6 and 7.4.3	Sections 7.2 6 and 7 4 3
10631(g)	Describe the expected future water supply projects and programs that may be undertaken by the water supplier to address water supply reliability in average, single-dry, and multiple-dry years.	Sections 6.2.2 and 7.2	Sections 6.1 4 and 7 2
10631(i)	Describe desalinated water project opportunities for long-term supply.	Section 7.4 2	Section 7 4 1
10631(j)	Retail suppliers will include documentation that they have provided their wholesale supplier(s) – if any – with water use projections from that source.	Not applicable	Not applicable
10631(j)	Wholesale suppliers will include documentation that they have provided their urban water suppliers with identification and quantification of the existing and planned sources of water available from the wholesale to the urban supplier during various water year types.	Not applicable	Appendix C
System Supplies (Recycled Water)			
10633	For wastewater and recycled water, coordinate with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area.	Section 6.2.1.3	Not applicable
10633(a)	Describe the wastewater collection and treatment systems in the supplier's service area. Include quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.	Section 6.2.1.3 and Table 6-6	Not applicable
10633(b)	Describe the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.	Table 6-6	Not applicable

Table 10-1 (continued)

California Water Code Section	UWMP Requirement	UWMP Location	
		Retail	Wholesale
10633(c)	Describe the recycled water currently being used in the supplier's service area.	Section 6.2.1.2	Not applicable
10633(d)	Describe and quantify the potential uses of recycled water and provide a determination of the technical and economic feasibility of those uses.	Section 6.2.2 and Table 6-7	Not applicable
10633(e)	Describe the projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected.	Table 6-7 and Table 6-5	Not applicable
10633(f)	Describe the actions which may be taken to encourage the use of recycled water and the projected results of these actions in terms of acre-feet of recycled water used per year.	Section 6.2.2.5	Not applicable
10633(g)	Provide a plan for optimizing the use of recycled water in the supplier's service area.	Section 6.2.2.5	Not applicable
Water Supply Reliability Assessment			
10620(f)	Describe water management tools and options to maximize resources and minimize the need to import water from other regions.	Section 6.2.2	Section 6.1.4
10631(c)(1)	Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage.	Sections 7.1 and 6.2.4	Sections 7.1 and 6.1.6
10631(c)(1)	Provide data for an average water year, a single dry water year, and multiple dry water years	Table 7-1 and Table 8-2	Table 7-1 and Table 8-5
10631(c)(2)	For any water source that may not be available at a consistent level of use, describe plans to supplement or replace that source	Section 7.1	Section 7.1
10634	Provide information on the quality of existing sources of water available to the supplier and the manner in which water quality affects water management strategies and supply reliability	Sections 6.1.5 and 6.2.3	Section 6.1.5
10635(a)	Assess the water supply reliability during normal, dry, and multiple dry water years by comparing the total water supply sources available to the water supplier with the total projected water use over the next 20 years.	Table 8-2	Table 7-5
10632(a) and 10632(a)(1)	Provide an urban water shortage contingency analysis that specifies stages of action and an outline of specific water supply conditions at each stage.	Table 8-1, Section 8.3.1, and Appendix L	Table 8-1, Section 8.3.2, and Appendix N
Water Shortage Contingency Planning			
10632(a)(2)	Provide an estimate of the minimum water supply available during each of the next three water years based on the driest three-year historic sequence for the agency.	Table 8-6	Table 8-6
10632(a)(3)	Identify actions to be undertaken by the urban water supplier in case of a catastrophic interruption of water supplies.	Section 8.4	Section 8.4
10632(a)(4)	Identify mandatory prohibitions against specific water use practices during water shortages.	Table 8-4	Not applicable
10632(a)(5)	Specify consumption reduction methods in the most restrictive stages.	Section 8.3.1.4 and Appendix L	Section 8.3.2 and Appendix N

Table 10-1 (continued)

California Water Code Section	UWMP Requirement	UWMP Location	
		Retail	Wholesale
10632(a)(6)	Indicated penalties or charges for excessive use, where applicable.	Sections 8.3.1.3 and 8.3.1.4	Appendix N
10632(a)(7)	Provide an analysis of the impacts of each of the actions and conditions in the water shortage contingency analysis on the revenues and expenditures of the urban water supplier, and proposed measures to overcome those impacts.	Section 8.3.4	Section 8.3.4
10632(a)(8)	Provide a draft water shortage contingency resolution or ordinance.	Appendix M	Appendix M
10632(a)(9)	Indicate a mechanism for determining actual reductions in water use pursuant to the water shortage contingency analysis.	Section 8.3.3	Section 8.3.3
Demand Management Measures			
10631(f)(1)	Retail suppliers shall provide a description of the nature and extent of each demand management measure implemented over the past five years. The description will address specific measures listed in code.	Section 9.2	Not applicable
10631(f)(2)	Wholesale suppliers shall describe specific demand management measures listed in code, their distribution system asset management program, and supplier assistance program.	Not applicable	Section 9.3
10631(j)	CUWCC members may submit their 2013- 2014 CUWCC BMP annual reports in lieu of, or in addition to, describing the DMM implementation in their UWMPs. This option is only allowable if the supplier has been found to be in full compliance with the CUWCC MOU.	Appendix O	Appendix O
Plan Adoption, Submittal, and Implementation			
10608.26(a)	Retail suppliers shall conduct a public hearing to discuss adoption, implementation, and economic impact of water use targets.	Section 10.1 and Appendix C	Not applicable
10621(b)	Notify, at least 60 days prior to the public hearing, any city or county within which the supplier provides water that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan.	Section 10.1 and Appendix C	Section 10.1 and Appendix C
10621(d)	Each urban water supplier shall update and submit its 2015 plan to the department by July 1, 2016.	Section 10.1 and Appendix C	Section 10.1 and Appendix C
10635(b)	Provide supporting documentation that Water Shortage Contingency Plan has been, or will be, provided to any city or county within which it provides water, no later than 60 days after the submission of the plan to DWR.	Section 10.1 and Appendix C	Section 10.1 and Appendix C
10642	Provide supporting documentation that the urban water supplier made the plan available for public inspection, published notice of the public hearing, and held a public hearing about the plan.	Section 10.1 and Appendix C	Section 10.1 and Appendix C
10642	The water supplier is to provide the time and place of the hearing to any city or county within which the supplier provides water.	Section 10.1 and Appendix C	Section 10.1 and Appendix C
10642	Provide supporting documentation that the plan has been adopted as prepared or modified.	Section 10.1 and Appendix C	Section 10.1 and Appendix C

Table 10-1 (continued)

California Water Code Section	UWMP Requirement	UWMP Location	
		Retail	Wholesale
10644(a)	Provide supporting documentation that the urban water supplier has submitted this UWMP to the California State Library.	Section 10.1 and Appendix C	Section 10.1 and Appendix C
10644(a)(1)	Provide supporting documentation that the urban water supplier has submitted this UWMP to any city or county within which the supplier provides water no later than 30 days after adoption.	Section 10.1 and Appendix C	Section 10.1 and Appendix C
10644(a)(2)	The plan, or amendments to the plan, submitted to the department shall be submitted electronically.	Section 10.1 and Appendix C	Section 10.1 and Appendix C
10645	Provide supporting documentation that, not later than 30 days after filing a copy of its plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Section 10.1 and Appendix C	Section 10.1 and Appendix C

2015 URBAN WATER MANAGEMENT PLAN

for the City and County of San Francisco

PUBLIC REVIEW DRAFT

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

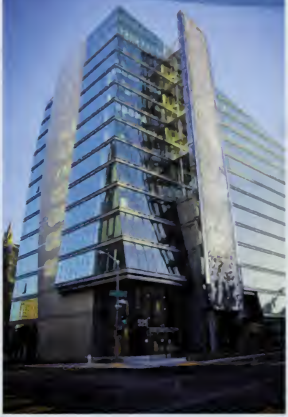
2015 URBAN WATER MANAGEMENT PLAN

for the City and County of San Francisco

APPENDICES

Prepared by: The San Francisco Public Utilities Commission

April 2016



San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

APPENDIX A

California Urban Water Management Planning Act of 1983 (Last amended: 2015)

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

CALIFORNIA WATER CODE DIVISION 6
PART 2.6. URBAN WATER MANAGEMENT PLANNING [10610 - 10656]

All codes have been updated to include the 2015 Statutes, effective January 1, 2016.

CHAPTER 1. General Declaration and Policy [10610 - 10610.4]

10610.
This part shall be known and may be cited as the "Urban Water Management Planning Act."

10610.2.
(a) The Legislature finds and declares all of the following:
(1) The waters of the state are a limited and renewable resource subject to ever-increasing demands
(2) The conservation and efficient use of urban water supplies are of statewide concern; however the planning for that use and the implementation of those plans can best be accomplished at the local level.
(3) A long-term, reliable supply of water is essential to protect the productivity of California's businesses and economic climate.
(4) As part of its long-range planning activities, every urban water supplier should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry water years.
(5) Public health issues have been raised over a number of contaminants that have been identified in certain local and imported water supplies.
(6) Implementing effective water management strategies, including groundwater storage projects and recycled water projects, may require specific water quality and salinity targets for meeting groundwater basins water quality objectives and promoting beneficial use of recycled water.
(7) Water quality regulations are becoming an increasingly important factor in water agencies' selection of raw water sources, treatment alternatives, and modifications to existing treatment facilities.
(8) Changes in drinking water quality standards may also impact the usefulness of water supplies and may ultimately impact supply reliability.
(9) The quality of source supplies can have a significant impact on water management strategies and supply reliability.
(b) This part is intended to provide assistance to water agencies in carrying out their long-term resource planning responsibilities to ensure adequate water supplies to meet existing and future demands for water.

10610.4.
The Legislature finds and declares that it is the policy of the state as follows:
(a) The management of urban water demands and efficient use of water shall be actively pursued to protect both the people of the state and their water resources.
(b) The management of urban water demands and efficient use of urban water supplies shall be a guiding criterion in public decisions.
(c) Urban water suppliers shall be required to develop water management plans to actively pursue the efficient use of available supplies.

CHAPTER 2. Definitions [10611 - 10617]

10611.
Unless the context otherwise requires, the definitions of this chapter govern the construction of this part.

10611.5.
"Demand management" means those water conservation measures, programs, and incentives that prevent the waste of water and promote the reasonable and efficient use and reuse of available supplies

10612.
"Customer" means a purchaser of water from a water supplier who uses the water for municipal purposes, including residential, commercial, governmental, and industrial uses.

10613.
"Efficient use" means those management measures that result in the most effective use of water so as to prevent its waste or unreasonable use or unreasonable method of use.

10614.
'Person" means any individual, firm, association, organization, partnership, business, trust, corporation, company, public agency, or any agency of such an entity.

10615.
"Plan" means an urban water management plan prepared pursuant to this part. A plan shall describe and evaluate sources of supply, reasonable and practical efficient uses, reclamation and demand management activities. The components of the plan may vary according to an individual community or area's characteristics and its capabilities to efficiently use and conserve water. The plan shall address measures for residential, commercial, governmental, and industrial water demand management as set forth in Article 2 (commencing with Section 10630) of Chapter 3. In addition, a strategy and time schedule for implementation shall be included in the plan.

10616.
"Public agency" means any board, commission, county, city and county, city, regional agency, district, or other public entity.

10616.5.
'Recycled water" means the reclamation and reuse of wastewater for beneficial use.

10617.
"Urban water supplier" means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. An urban water supplier includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells for ultimate resale to customers. This part applies only to water supplied from public water systems subject to Chapter 4 (commencing with Section 116275) of Part 12 of Division 104 of the Health and Safety Code.

CHAPTER 3. Urban Water Management Plans [10620 - 10645]

ARTICLE 1. General Provisions [10620 - 10621]

10620.
(a) Every urban water supplier shall prepare and adopt an urban water management plan in the manner set forth in Article 3 (commencing with Section 10640).
(b) Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.
(c) An urban water supplier indirectly providing water shall not include planning elements in its water management plan as provided in Article 2 (commencing with Section 10630) that would be applicable to urban water suppliers or public agencies directly providing water, or to their customers, without the consent of those suppliers or public agencies.
(d) (1) An urban water supplier may satisfy the requirements of this part by participation in areawide, regional, watershed, or basinwide urban water management planning where those plans will reduce preparation costs and contribute to the achievement of conservation and efficient water use.
(2) Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.
(e) The urban water supplier may prepare the plan with its own staff, by contract, or in cooperation with other governmental agencies.
(f) An urban water supplier shall describe in the plan water management tools and options used by that entity that will maximize resources and minimize the need to import water from other regions.

10621.
(a) Each urban water supplier shall update its plan at least once every five years on or before December 31, in years ending in five and zero, except as provided in subdivisions (d) and (e).
(b) Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days before the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. The urban water supplier may consult with, and obtain comments from, any city or county that receives notice pursuant to this subdivision.
(c) The amendments to, or changes in, the plan shall be adopted and filed in the manner set forth in Article 3 (commencing with Section 10640).
(d) Each urban water supplier shall update and submit its 2015 plan to the department by July 1, 2016.
(e) Each urban water supplier shall update and submit its 2020 plan to the department by July 1, 2021.

ARTICLE 2. Contents of Plans [10630 - 10634]

10630.
It is the intention of the Legislature, in enacting this part, to permit levels of water management planning commensurate with the numbers of customers served and the volume of water supplied.

10631.
A plan shall be adopted in accordance with this chapter that shall do all of the following:
(a) Describe the service area of the supplier, including current and projected population, climate, and other demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.
(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments described in subdivision (a). If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information shall be included in the plan:
(1) A copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management.
(2) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For basins that a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.
(3) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.
(4) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.
(c) (1) Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for each of the following:
(A) An average water year.
(B) A single-dry water year.
(C) Multiple-dry water years.
(2) For any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality, or climatic factors, describe plans to supplement or replace that source with alternative sources or water demand management measures, to the extent practicable.

(d) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.
(e) (1) Quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, identifying the uses among water use sectors, including, but not necessarily limited to, all of the following uses:
(A) Single-family residential.
(B) Multifamily.
(C) Commercial.
(D) Industrial.
(E) Institutional and governmental.
(F) Landscape.
(G) Sales to other agencies.
(H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof.
(I) Agricultural.
(J) Distribution system water loss.
(2) The water use projections shall be in the same five-year increments described in subdivision (a).
(3) (A) For the 2015 urban water management plan update, the distribution system water loss shall be quantified for the most recent 12-month period available. For all subsequent updates, the distribution system water loss shall be quantified for each of the five years preceding the plan update.
(B) The distribution system water loss quantification shall be reported in accordance with a worksheet approved or developed by the department through a public process. The water loss quantification worksheet shall be based on the water system balance methodology developed by the American Water Works Association.
(4) (A) If available and applicable to an urban water supplier, water use projections may display and account for the water savings estimated to result from adopted codes, standards, ordinances, or transportation and land use plans identified by the urban water supplier, as applicable to the service area.
(B) To the extent that an urban water supplier reports the information described in subparagraph (A), an urban water supplier shall do both of the following:
(i) Provide citations of the various codes, standards, ordinances, or transportation and land use plans utilized in making the projections.
(ii) Indicate the extent that the water use projections consider savings from codes, standards, ordinances, or transportation and land use plans. Water use projections that do not account for these water savings shall be noted of that fact.
(f) Provide a description of the supplier's water demand management measures. This description shall include all of the following:
(1) (A) For an urban retail water supplier, as defined in Section 10608.12, a narrative description that addresses the nature and extent of each water demand management measure implemented over the past five years. The narrative shall describe the water demand management measures that the supplier plans to implement to achieve its water use targets pursuant to Section 10608.20.
(B) The narrative pursuant to this paragraph shall include descriptions of the following water demand management measures:
(i) Water waste prevention ordinances.
(ii) Metering.
(iii) Conservation pricing.
(iv) Public education and outreach.
(v) Programs to assess and manage distribution system real loss.
(vi) Water conservation program coordination and staffing support.
(vii) Other demand management measures that have a significant impact on water use as measured in gallons per capita per day, including innovative measures, if implemented.
(2) For an urban wholesale water supplier, as defined in Section 10608.12, a narrative description of the items in clauses (ii), (iv), (vi), and (vii) of subparagraph (B) of paragraph (1), and a narrative description of its distribution system asset management and wholesale supplier assistance programs.
(g) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use, as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in average, single-dry, and multiple-dry water years. The

description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.
(h) Describe the opportunities for development of desalinated water, including, but not limited to, ocean water, brackish water, and groundwater, as a long-term supply.
(i) For purposes of this part, urban water suppliers that are members of the California Urban Water Conservation Council shall be deemed in compliance with the requirements of subdivision (f) by complying with all the provisions of the "Memorandum of Understanding Regarding Urban Water Conservation in California," dated December 10, 2008, as it may be amended, and by submitting the annual reports required by Section 6.2 of that memorandum.
(j) An urban water supplier that relies upon a wholesale agency for a source of water shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available. The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five-year increments, and during various water-year types in accordance with subdivision (c). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (c).

10631.1.
(a) The water use projections required by Section 10631 shall include projected water use for single-family and multifamily residential housing needed for lower income households, as defined in Section 50079.5 of the Health and Safety Code, as identified in the housing element of any city, county, or city and county in the service area of the supplier.
(b) It is the intent of the Legislature that the identification of projected water use for single-family and multifamily residential housing for lower income households will assist a supplier in complying with the requirement under Section 65589.7 of the Government Code to grant a priority for the provision of service to housing units affordable to lower income households.

10631.2.
(a) In addition to the requirements of Section 10631, an urban water management plan may, but is not required to, include any of the following information:
(1) An estimate of the amount of energy used to extract or divert water supplies.
(2) An estimate of the amount of energy used to convey water supplies to the water treatment plants or distribution systems.
(3) An estimate of the amount of energy used to treat water supplies.
(4) An estimate of the amount of energy used to distribute water supplies through its distribution systems.
(5) An estimate of the amount of energy used for treated water supplies in comparison to the amount used for nontreated water supplies.
(6) An estimate of the amount of energy used to place water into or withdraw from storage.
(7) Any other energy-related information the urban water supplier deems appropriate.
(b) The department shall include in its guidance for the preparation of urban water management plans a methodology for the voluntary calculation or estimation of the energy intensity of urban water systems. The department may consider studies and calculations conducted by the Public Utilities Commission in developing the methodology.

10631.5.
(a) (1) Beginning January 1, 2009, the terms of, and eligibility for, a water management grant or loan made to an urban water supplier and awarded or administered by the department, state board, or California Bay-Delta Authority or its successor agency shall be conditioned on the implementation of the water demand management measures described in Section 10631, as determined by the department pursuant to subdivision (b).
(2) For the purposes of this section, water management grants and loans include funding for programs and projects for surface water or groundwater storage, recycling, desalination, water conservation, water

supply reliability, and water supply augmentation. This section does not apply to water management projects funded by the federal American Recovery and Reinvestment Act of 2009 (Public Law 111-5).
(3) Notwithstanding paragraph (1), the department shall determine that an urban water supplier is eligible for a water management grant or loan even though the supplier is not implementing all of the water demand management measures described in Section 10631, if the urban water supplier has submitted to the department for approval a schedule, financing plan, and budget, to be included in the grant or loan agreement, for implementation of the water demand management measures. The supplier may request grant or loan funds to implement the water demand management measures to the extent the request is consistent with the eligibility requirements applicable to the water management funds.
(4) (A) Notwithstanding paragraph (1), the department shall determine that an urban water supplier is eligible for a water management grant or loan even though the supplier is not implementing all of the water demand management measures described in Section 10631, if an urban water supplier submits to the department for approval documentation demonstrating that a water demand management measure is not locally cost effective. If the department determines that the documentation submitted by the urban water supplier fails to demonstrate that a water demand management measure is not locally cost effective, the department shall notify the urban water supplier and the agency administering the grant or loan program within 120 days that the documentation does not satisfy the requirements for an exemption, and include in that notification a detailed statement to support the determination.
(B) For purposes of this paragraph, "not locally cost effective" means that the present value of the local benefits of implementing a water demand management measure is less than the present value of the local costs of implementing that measure.
(b) (1) The department, in consultation with the state board and the California Bay-Delta Authority or its successor agency, and after soliciting public comment regarding eligibility requirements, shall develop eligibility requirements to implement the requirement of paragraph (1) of subdivision (a). In establishing these eligibility requirements, the department shall do both of the following:
(A) Consider the conservation measures described in the Memorandum of Understanding Regarding Urban Water Conservation in California, and alternative conservation approaches that provide equal or greater water savings.
(B) Recognize the different legal, technical, fiscal, and practical roles and responsibilities of wholesale water suppliers and retail water suppliers.
(2) (A) For the purposes of this section, the department shall determine whether an urban water supplier is implementing all of the water demand management measures described in Section 10631 based on either, or a combination, of the following:
(i) Compliance on an individual basis.
(ii) Compliance on a regional basis. Regional compliance shall require participation in a regional conservation program consisting of two or more urban water suppliers that achieves the level of conservation or water efficiency savings equivalent to the amount of conservation or savings achieved if each of the participating urban water suppliers implemented the water demand management measures. The urban water supplier administering the regional program shall provide participating urban water suppliers and the department with data to demonstrate that the regional program is consistent with this clause. The department shall review the data to determine whether the urban water suppliers in the regional program are meeting the eligibility requirements.
(B) The department may require additional information for any determination pursuant to this section.
(3) The department shall not deny eligibility to an urban water supplier in compliance with the requirements of this section that is participating in a multiagency water project, or an integrated regional water management plan, developed pursuant to Section 75026 of the Public Resources Code, solely on the basis that one or more of the agencies participating in the project or plan is not implementing all of the water demand management measures described in Section 10631.
(c) In establishing guidelines pursuant to the specific funding authorization for any water management grant or loan program subject to this section, the agency administering the grant or loan program shall include in the guidelines the eligibility requirements developed by the department pursuant to subdivision (b).
(d) Upon receipt of a water management grant or loan application by an agency administering a grant and loan program subject to this section, the agency shall request an eligibility determination from the department with respect to the requirements of this section. The department shall respond to the request within 60 days of the request.

(e) The urban water supplier may submit to the department copies of its annual reports and other relevant documents to assist the department in determining whether the urban water supplier is implementing or scheduling the implementation of water demand management activities. In addition, for urban water suppliers that are signatories to the Memorandum of Understanding Regarding Urban Water Conservation in California and submit biennial reports to the California Urban Water Conservation Council in accordance with the memorandum, the department may use these reports to assist in tracking the implementation of water demand management measures.
(f) This section shall remain in effect only until July 1, 2016, and as of that date is repealed, unless a later enacted statute, that is enacted before July 1, 2016, deletes or extends that date.

10631.7.
The department, in consultation with the California Urban Water Conservation Council, shall convene an independent technical panel to provide information and recommendations to the department and the Legislature on new demand management measures, technologies, and approaches. The panel shall consist of no more than seven members, who shall be selected by the department to reflect a balanced representation of experts. The panel shall have at least one, but no more than two, representatives from each of the following: retail water suppliers, environmental organizations, the business community, wholesale water suppliers, and academia. The panel shall be convened by January 1, 2009, and shall report to the Legislature no later than January 1, 2010, and every five years thereafter. The department shall review the panel report and include in the final report to the Legislature the department's recommendations and comments regarding the panel process and the panel's recommendations.

10632.
(a) The plan shall provide an urban water shortage contingency analysis that includes each of the following elements that are within the authority of the urban water supplier:
(1) Stages of action to be undertaken by the urban water supplier in response to water supply shortages, including up to a 50 percent reduction in water supply, and an outline of specific water supply conditions that are applicable to each stage.
(2) An estimate of the minimum water supply available during each of the next three water years based on the driest three-year historic sequence for the agency's water supply.
(3) Actions to be undertaken by the urban water supplier to prepare for, and implement during, a catastrophic interruption of water supplies including, but not limited to, a regional power outage, an earthquake, or other disaster.
(4) Additional, mandatory prohibitions against specific water use practices during water shortages, including, but not limited to, prohibiting the use of potable water for street cleaning.
(5) Consumption reduction methods in the most restrictive stages. Each urban water supplier may use any type of consumption reduction methods in its water shortage contingency analysis that would reduce water use, are appropriate for its area, and have the ability to achieve a water use reduction consistent with up to a 50 percent reduction in water supply.
(6) Penalties or charges for excessive use, where applicable.
(7) An analysis of the impacts of each of the actions and conditions described in paragraphs (1) to (6), inclusive, on the revenues and expenditures of the urban water supplier, and proposed measures to overcome those impacts, such as the development of reserves and rate adjustments.
(8) A draft water shortage contingency resolution or ordinance.
(9) A mechanism for determining actual reductions in water use pursuant to the urban water shortage contingency analysis.
(b) Commencing with the urban water management plan update due July 1, 2016, for purposes of developing the water shortage contingency analysis pursuant to subdivision (a), the urban water supplier shall analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas, as defined in subdivision (a) of Section 115921 of the Health and Safety Code.

10632.5.
(a) In addition to the requirements of paragraph (3) of subdivision (a) of Section 10632, beginning January 1, 2020, the plan shall include a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities.

(b) An urban water supplier shall update the seismic risk assessment and mitigation plan when updating its urban water management plan as required by Section 10621.
(c) An urban water supplier may comply with this section by submitting, pursuant to Section 10644, a copy of the most recent adopted local hazard mitigation plan or multihazard mitigation plan under the federal Disaster Mitigation Act of 2000 (Public Law 106-390) if the local hazard mitigation plan or multihazard mitigation plan addresses seismic risk.

10633.
The plan shall provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier. The preparation of the plan shall be coordinated with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area, and shall include all of the following:
(a) A description of the wastewater collection and treatment systems in the supplier's service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.
(b) A description of the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.
(c) A description of the recycled water currently being used in the supplier's service area, including, but not limited to, the type, place, and quantity of use.
(d) A description and quantification of the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, indirect potable reuse, and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.
(e) The projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected pursuant to this subdivision.
(f) A description of actions, including financial incentives, which may be taken to encourage the use of recycled water, and the projected results of these actions in terms of acre-feet of recycled water used per year.
(g) A plan for optimizing the use of recycled water in the supplier's service area, including actions to facilitate the installation of dual distribution systems, to promote recirculating uses, to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use.

10634.
The plan shall include information, to the extent practicable, relating to the quality of existing sources of water available to the supplier over the same five-year increments as described in subdivision (a) of Section 10631, and the manner in which water quality affects water management strategies and supply reliability.

ARTICLE 2.5. Water Service Reliability [10635 - 10635.]

10635.
(a) Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and multiple dry water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.
(b) The urban water supplier shall provide that portion of its urban water management plan prepared pursuant to this article to any city or county within which it provides water supplies no later than 60 days after the submission of its urban water management plan.
(c) Nothing in this article is intended to create a right or entitlement to water service or any specific level of water service.

(d) Nothing in this article is intended to change existing law concerning an urban water supplier's obligation to provide water service to its existing customers or to any potential future customers.

ARTICLE 3. Adoption and Implementation of Plans [10640 - 10645]

10640.
Every urban water supplier required to prepare a plan pursuant to this part shall prepare its plan pursuant to Article 2 (commencing with Section 10630).
The supplier shall likewise periodically review the plan as required by Section 10621, and any amendments or changes required as a result of that review shall be adopted pursuant to this article.

10641.
An urban water supplier required to prepare a plan may consult with, and obtain comments from, any public agency or state agency or any person who has special expertise with respect to water demand management methods and techniques.

10642.
Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan. Prior to adopting a plan, the urban water supplier shall make the plan available for public inspection and shall hold a public hearing thereon. Prior to the hearing, notice of the time and place of hearing shall be published within the jurisdiction of the publicly owned water supplier pursuant to Section 6066 of the Government Code. The urban water supplier shall provide notice of the time and place of hearing to any city or county within which the supplier provides water supplies. A privately owned water supplier shall provide an equivalent notice within its service area. After the hearing, the plan shall be adopted as prepared or as modified after the hearing.

10643.
An urban water supplier shall implement its plan adopted pursuant to this chapter in accordance with the schedule set forth in its plan.

10644.
(a) (1) An urban water supplier shall submit to the department, the California State Library, and any city or county within which the supplier provides water supplies a copy of its plan no later than 30 days after adoption. Copies of amendments or changes to the plans shall be submitted to the department, the California State Library, and any city or county within which the supplier provides water supplies within 30 days after adoption.
(2) The plan, or amendments to the plan, submitted to the department pursuant to paragraph (1) shall be submitted electronically and shall include any standardized forms, tables, or displays specified by the department.
(b) (1) (A) Notwithstanding Section 10231.5 of the Government Code, and except as provided in subparagraph (B), the department shall prepare and submit to the Legislature, on or before December 31, in the years ending in six and one, a report summarizing the status of the plans adopted pursuant to this part. The report prepared by the department shall identify the exemplary elements of the individual plans. The department shall provide a copy of the report to each urban water supplier that has submitted its plan to the department. The department shall also prepare reports and provide data for any legislative hearings designed to consider the effectiveness of plans submitted pursuant to this part.
(B) The department shall submit the report to the Legislature for the 2015 plans by July 1, 2017, and the report to the Legislature for the 2020 plans by July 1, 2022.
(2) A report to be submitted pursuant to paragraph (1) shall be submitted in compliance with Section 9795 of the Government Code.
(c) (1) For the purpose of identifying the exemplary elements of the individual plans, the department shall identify in the report water demand management measures adopted and implemented by specific urban water suppliers, and identified pursuant to Section 10631, that achieve water savings significantly above the levels established by the department to meet the requirements of Section 10631.5.

(2) The department shall distribute to the panel convened pursuant to Section 10631.7 the results achieved by the implementation of those water demand management measures described in paragraph (1).
(3) The department shall make available to the public the standard the department will use to identify exemplary water demand management measures.

10645.
Not later than 30 days after filing a copy of its plan with the department, the urban water supplier and the department shall make the plan available for public review during normal business hours.

CHAPTER 4. Miscellaneous Provisions [10650 - 10656]

10650.
Any actions or proceedings to attack, review, set aside, void, or annul the acts or decisions of an urban water supplier on the grounds of noncompliance with this part shall be commenced as follows:
(a) An action or proceeding alleging failure to adopt a plan shall be commenced within 18 months after that adoption is required by this part.
(b) Any action or proceeding alleging that a plan, or action taken pursuant to the plan, does not comply with this part shall be commenced within 90 days after filing of the plan or amendment thereto pursuant to Section 10644 or the taking of that action.
(Amended by Stats. 1995, Ch. 854, Sec. 15. Effective January 1, 1996.)
10651.
In any action or proceeding to attack, review, set aside, void, or annul a plan, or an action taken pursuant to the plan by an urban water supplier on the grounds of noncompliance with this part, the inquiry shall extend only to whether there was a prejudicial abuse of discretion. Abuse of discretion is established if the supplier has not proceeded in a manner required by law or if the action by the water supplier is not supported by substantial evidence.

10652.
The California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) does not apply to the preparation and adoption of plans pursuant to this part or to the implementation of actions taken pursuant to Section 10632. Nothing in this part shall be interpreted as exempting from the California Environmental Quality Act any project that would significantly affect water supplies for fish and wildlife, or any project for implementation of the plan, other than projects implementing Section 10632, or any project for expanded or additional water supplies.

10653.
The adoption of a plan shall satisfy any requirements of state law, regulation, or order, including those of the State Water Resources Control Board and the Public Utilities Commission, for the preparation of water management plans or conservation plans; provided, that if the State Water Resources Control Board or the Public Utilities Commission requires additional information concerning water conservation to implement its existing authority, nothing in this part shall be deemed to limit the board or the commission in obtaining that information. The requirements of this part shall be satisfied by any urban water demand management plan prepared to meet federal laws or regulations after the effective date of this part, and which substantially meets the requirements of this part, or by any existing urban water management plan which includes the contents of a plan required under this part.

10654.
An urban water supplier may recover in its rates the costs incurred in preparing its plan and implementing the reasonable water conservation measures included in the plan. Any best water management practice that is included in the plan that is identified in the "Memorandum of Understanding Regarding Urban Water Conservation in California" is deemed to be reasonable for the purposes of this section.

10655.
If any provision of this part or the application thereof to any person or circumstances is held invalid, that invalidity shall not affect other provisions or applications of this part which can be given effect without the invalid provision or application thereof, and to this end the provisions of this part are severable.

10656.
An urban water supplier that does not prepare, adopt, and submit its urban water management plan to the department in accordance with this part, is ineligible to receive funding pursuant to Division 24 (commencing with Section 78500) or Division 26 (commencing with Section 79000), or receive drought assistance from the state until the urban water management plan is submitted pursuant to this article.

This page intentionally left blank.

APPENDIX B

UWMP Standardized Tables

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission
April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

****DRAFT****

SFPUC 2015 UWMP Update
DWR Standardized Tables
(Appendix B)

Table 2-1 Retail Only: Public Water Systems			
Public Water System Number	Public Water System Name	Number of Municipal Connections 2015	Volume of Water Supplied 2015
CA3810011	SFPUC - CITY DISTRIBUTION DIVISION	173,774	71,570
CA0110018	SFPUC - PLEASANTON WELLS	1	360
CA0110012	SFPUC - TOWN OF SUNOL	119	60
	TOTAL	173,894	71,990

NOTES:
Data for the Town of Sunol are for calendar year 2015, but are used to approximate data for FY 2014-15.

Table 2-2: Plan Identification			
Select Only One	Type of Plan		Name of RUWMP or Regional Alliance *if applicable* *drop down list*
☑	**Individual UWMP**		
	☐	Water Supplier is also a member of a RUWMP	
	☐	Water Supplier is also a member of a Regional Alliance	
☐	**Regional Urban Water Management Plan (RUWMP)**		
NOTES:			

Table 2-3: Agency Identification	
Type of Agency (select one or both)	
☑	Agency is a wholesaler
☑	Agency is a retailer
Fiscal or Calendar Year (select one)	
☐	UWMP Tables Are in Calendar Years
☑	UWMP Tables Are in Fiscal Years
If Using Fiscal Years Provide Month and Date that the Fiscal Year Begins (mm/dd)	
01/07	
Units of Measure Used in UWMP (select from Drop down)	
Unit	AF
NOTES: Values are rounded to the nearest 10 AF in the standardized tables. The units of measure used in the body of the UWMP are millions of gallons per day (mgd).	

Table 2-4 Retail: Water Supplier Information Exchange
The retail supplier has informed the following wholesale supplier(s) of projected water use in accordance with CWC 10631.
Wholesale Water Supplier Name
Not applicable. The SFPUC does not receive water from any wholesale supplier.

Table 2-4 Wholesale: Water Supplier Information Exchange (select one)	
☑	Supplier has informed more than 10 other water suppliers of water supplies available in accordance with CWC 10631. Completion of the table below is optional. If not completed include a list of the water suppliers that were informed. Provide page number for location of the list.
☐	Supplier has informed 10 or fewer other water suppliers of water supplies available in accordance with CWC 10631. Complete the table below.
Water Supplier Name *(Add additional rows as needed)*	
1	City of Brisbane
2	City of Burlingame
3	City of Daly City
4	City of East Palo Alto
5	City of Hayward
6	City of Menlo Park
7	City of Millbrae
8	City of Milpitas
9	City of Mountain View
10	City of Palo Alto
11	City of Redwood City
12	City of San Bruno
13	City of San Jose
14	City of Santa Clara
15	City of Sunnyvale
16	Town of Hillsborough
17	Alameda County Water District
18	Coastside County Water District
19	Cordilleras Mutual Water Company
20	Estero Municipal Improvement District
21	Guadalupe Valley Municipal Improvement District
22	Mid-Peninsula Water District
23	North Coast County Water District
24	Purissima Hills Water District
25	Westborough Water District
26	California Water Service Company
27	Stanford University
28	Groveland Community Service District [(1)]

NOTES:
(1) Groveland Community Service District (CSD) is contractually defined as a retail customer of the SFPUC and is accounted as such in SFPUC's previous planning documents. However, for the purpose of the 2015 UWMP update, SFPUC was directed by DWR to report Groveland CSD as a wholesale customer.

Table 3-1 Retail: Population - Current and Projected						
Population Served	2015	2020	2025	2030	2035	2040*(opt)*
	847,370	892,168	936,568	983,568	1,034,268	1,087,468

NOTES:
Population projections reflect the total population of in-City and suburban retail customers.
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore reported in Table 3-1 Wholesale instead of this table. However, the corresponding retail table in the UWMP includes Groveland CSD.

Table 3-1 Wholesale: Population - Current and Projected						
Population Served	2015	2020	2025	2030	2035	2040*(opt)*
	1,800,897	1,883,343	1,972,308	2,062,427	2,157,465	2,242,606

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is included this table. However, the corresponding wholesale table in the UWMP excludes Groveland CSD.

Table 4-1 Retail: Demands for Potable and Raw Water - Actual			
Use Type *(Add additional rows as needed)*	2015 Actual		
Use Drop down list *May select each use multiple times These are the only Use Types that will be recognized by the WUEdata online submittal tool*	Additional Description *(as needed)*	Level of Treatment When Delivered *Drop down list*	Volume
Single Family		Drinking Water	16,350
Multi-Family		Drinking Water	24,870
Other	Non-residential: Commercial, Industrial, and Institutional	Drinking Water	28,300
Other	Groundwater for Castlewood CSA	Drinking Water	360
Other	Groundwater for irrigation purposes	Raw Water	2,090
Losses	Includes both apparent loss and real loss (see Appendix N for AWWA audit worksheet)	Drinking Water	5,940
		TOTAL	77,910

NOTES:
Per DWR direction, Groveland CSD is not accounted for as a retail customer, but rather wholesale customer in all the standardized tables. Their demand is included in Table 4-1 Wholesale. However, the corresponding retail table in the UWMP includes Groveland CSD.

Table 4-1 Wholesale: Demands for Potable and Raw Water - Actual			
Use Type *(Add additional rows as needed)*	2015 Actual		
Use Drop down list *May select each use multiple times* *These are the only use types that will be recognized by the WUE data online submittal tool*	Additional Description *(as needed)*	Level of Treatment When Delivered *Drop down list*	Volume
Sales to other agencies		Drinking Water	143,790
		TOTAL	143,790

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is included in this table. However, the corresponding wholesale table in the UWMP excludes Groveland CSD.

DRAFT

SFPUC 2015 UWMP Update
DWR Standardized Tables
(Appendix B)

Table 4-2 Retail: Demands for Potable and Raw Water - Projected

Use Type *(Add additional rows as needed)*	Additional Description *(as needed)*	Projected Water Use *Report To the Extent that Records are Available*				
Use Drop down list *May select each use multiple times These are the only Use Types that will be recognized by the WUEdata online submittal tool*		2020	2025	2030	2035	2040-opt
Single Family		17,470	18,370	20,050	21,950	23,740
Multi-Family		24,750	25,540	26,880	28,000	29,340
Other	All non-residential	35,170	35,160	33,600	34,610	35,960
Losses		6,720	6,720	6,720	6,720	6,720
	TOTAL	84,110	85,790	87,250	91,280	95,760

NOTES:
Per DWR direction, Groveland CSD is not accounted for as a retail customer, but rather wholesale customer. Their demand is included in Table 4-2 Wholesale. However, the corresponding retail table in the UWMP includes Groveland CSD.

Table 4-2 Wholesale: Demands for Potable and Raw Water - Projected

Use Type *(Add additional rows as needed)*	Additional Description *(as needed)*	Projected Water Use *Report To the Extent that Records are Available*				
Drop down list *May select each use multiple times These are the only Use Types that will be recognized by the WUEdata online submittal tool.*		2020	2025	2030	2035	2040-opt
Sales to other agencies	Contract obligations.	206,640	206,640	206,640	206,640	206,640
	TOTAL	206,640	206,640	206,640	206,640	206,640

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer in this standardized table. However, the corresponding wholesale table in the UWMP excludes Groveland CSD.

Table 4-3 Retail: Total Water Demands						
	2015	2020	2025	2030	2035	2040 *(opt)*
Potable and Raw Water *From Tables 4-1 and 4-2*	77,910	84,110	86,240	87,250	91,280	95,760
Recycled Water Demand *From Table 6-4*	280	2,130	2,130	4,370	4,370	4,370
TOTAL WATER DEMAND	78,190	86,240	87,920	91,620	95,650	100,130

**Recycled water demand fields will be blank until Table 6-4 is complete.*

NOTES:
Recycled water use for landscape irrigation in 2015 reflects a very small amount of recycled water dispensed from the Southeast Water Pollution Control Plant recycled water truck-fill station for various approved uses (e.g., street tree irrigation, sewer flushing, etc.). Future projections reflect recycled water supply served by the Westside Recycled Water Project.
Also note that per DWR direction, Groveland CSD is not accounted for as a retail customer, but rather wholesale customer in all standardized tables. Their demand is included in Table 4-3 Wholesale. However, the corresponding retail table in the UWMP includes Groveland CSD.

Table 4-3 Wholesale: Total Water Demands						
	2015	2020	2025	2030	2035	2040 *(opt)*
Potable and Raw Water *From Tables 4-1 and 4-2*	143,790	206,640	206,640	206,640	206,640	206,640
Recycled Water Demand *From Table 6-4*	0	0	0	0	0	0
TOTAL WATER DEMAND	143,790	206,640	206,640	206,640	206,640	206,640
**Recycled water demand fields will be blank until Table 6-4 is complete.*						

NOTES: Demand in 2015 reflects actual deliveries in FY 14/15. Future demands reflect SFPUC's contractual obligations to its wholesale customers. Per DWR direction, Groveland CSD is accounted for as a wholesale customer in all the standardized tables and is therefore included in this table. However, the corresponding wholesale table in the UWMP excludes Groveland CSD.

Table 4-4 Retail: 12 Month Water Loss Audit Reporting	
Reporting Period Start Date (mm/yyyy)	Volume of Water Loss
07/2014	5,940
** Taken from the field "Water Losses" (a combination of apparent losses and real losses) from the AWWA worksheet.*	
NOTES:	

Table 4-4 Wholesale: 12 Month Water Loss Audit Reporting

Reporting Period Start Date (mm/yyyy)	Volume of Water Loss
07/2014	-510

** Taken from the field "Water Losses" (a combination of apparent losses and real losses) from the AWWA worksheet.*

NOTES:
For this 2015 UWMP, the SFPUC conducted a detailed water audit of its wholesale transmission system for the first time. Using the AWWA M36 method and associated worksheets (Appendix I), the audit resulted in a negative water loss value of -510 AF (-165.35 MG/Yr or -0.45 mgd) and is therefore considered to be inconclusive. However, this audit serves as an informative initial assessment to which future audits may be compared.

Table 4-5 Retail Only: Inclusion in Water Use Projections	
Are Future Water Savings Included in Projections? (Refer to Appendix K of UWMP Guidebook) *Drop down list (y/n)*	Yes
If "Yes" to above, state the section or page number, in the cell to the right, where citations of the codes, ordinances, etc... utilized in demand projections are found.	Appendix H
Are Lower Income Residential Demands Included In Projections? *Drop down list (y/n)*	Yes
NOTES:	

Table 5-1 Baselines and Targets Summary
Retail Agency or Regional Alliance Only

Baseline Period	Start Years	End Years	Average GPCD	2015 Interim Target	Confirmed 2020 Target
10-15 year	2001	2010	106	101	96
5 Year	2006	2010	101		

NOTES: Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

Table 5-2: 2015 Compliance *Retail Agency or Regional Alliance Only*							
2015 Actual GPCD	2015 Interim Target	Optional Adjustments to 2015 GPCD				Actual (or Adjusted Actual) as Percent of Target	In Compliance? Y/N
		Extraordinary Events	Economic Adjustment	Weather Normalization	Adjusted Actual 2015 GPCD		
82	101	N/A	N/A	N/A	N/A	81%	Y

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

Table 6-1 Retail: Groundwater Volume Pumped						
☐	Supplier does not pump goundwater. The supplier will not complete the table below.					
Groundwater Type *Drop Down List* *May use each category multiple times*	Location or Basin Name	2011	2012	2013	2014	2015
Alluvial Basin	Westside Basin (1)	1,430	1,340	1,650	1,670	1,670
Alluvial Basin	Livermore Valley Basin, Central Groundwater Sub Basin (2)	410	460	360	460	360
Alluvial Basin	Sunol Infiltration Gallery (3)	380	410	490	490	420
TOTAL		2,220	2,210	2,500	2,620	2,450

NOTES:
(1) Data for the Westside Basin are obtained from the 2014 Annual Groundwater Monitoring Report, Westside Basin (SFPUC, April 2015). Pumping volumes are reported on a calendar year basis, but are used to approximate fiscal year data for this table. Data for 2015 were not available as of the publication of this document, so data for calendar year 2014 is applied to 2015.
(2) This basin is the source of water for the Castlewood Well System. Pumping volumes are assumed to be equivalent to billed consumption for Castlewood CSA.
(3) Subsurface diversions from the Sunol Filter Gallery are assumed to be equivalent to billed consumption for Sunol Valley Golf Course.

Table 6-1 Wholesale: Groundwater Volume Pumped						
☑	Supplier does not pump goundwater. The supplier will not complete the table below.					
Groundwater Type *Drop Down List* *May use each category multiple times*	Location or Basin Name	2011	2012	2013	2014	2015
TOTAL		0	0	0	0	0
NOTES:						

Table 6-2 Retail: Wastewater Collected Within Service Area in 2015

☐	There is no wastewater collection system. The supplier will not complete the table below.					
100%	Percentage of 2015 service area covered by wastewater collection system *(optional)*					
100%	Percentage of 2015 service area population covered by wastewater collection system *(optional)*					
Wastewater Collection			**Receiving Wastewater Treatment**			
Name of Wastewater Collection Agency	Wastewater Volume Metered or Estimated? *Drop Down List*	Volume of Wastewater Collected in 2015	Name of Wastewater Treatment Agency Receiving Collected Wastewater	Treatment Plant Name	Is WWTP Located Within UWMP Area? *Drop Down List*	Is WWTP Operation Contracted to a Third Party? *(optional)* *Drop Down List*
SFPUC	Metered	68,120	SFPUC	Southeast Water Pollution Control Plant and North Point Wet Weather Facility	Yes	No
SFPUC	Metered	14,420	SFPUC	Oceanside Water Pollution Control Plant	Yes	No
City and County of San Francisco[1]	Estimated	710	City and County of San Francisco	Mel Leong Treatment Plant	Yes	No
Total Wastewater Collected from Service Area in 2015:		83,250				

NOTES:
(1) Volumetric data for Mel Leong Treatment Plant are obtained from its NPDES permit, which provides estimates of volumes in 2011. Per the permit, up to 0.72 mgd can be diverted to an onsite recycled water facility, which provides tertiary-treated recycled water for irrigation and other non-potable uses at SFO.

Table 6-3 Retail: Wastewater Treatment and Discharge Within Service Area in 2015

☐ No wastewater is treated or disposed of within the UWMP service area. The supplier will not complete the table below.

Wastewater Treatment Plant Name	Discharge Location Name or Identifier	Discharge Location Description	Wastewater Discharge ID Number *(optional)*	Method of Disposal *Drop down list*	Does This Plant Treat Wastewater Generated Outside the Service Area?	Treatment Level *Drop down list*	2015 volumes			
							Wastewater Treated	Discharged Treated Wastewater	Recycled Within Service Area	Recycled Outside of Service Area
Southeast Water Pollution Control Plant and North Point Wet Weather Facility (1)	Discharge Point No. 001; Discharge Point No. 002; Discharge Point Nos. 003-006	Lower San Francisco Bay; Islais Creek; Central San Francisco Bay	2 386010001	Bay or estuary outfall	Yes	Secondary, Undisinfected	68,120	57,070	0	0
Oceanside Water Pollution Control Plant	Discharge Point No. 001	Pacific Ocean, Offshore	2 386009001	Ocean outfall	Yes	Secondary, Undisinfected	14,420	15,040	0	0
Mel Leong Treatment Plant (2)	North Bayside System Unit	Lower San Francisco Bay	2 417033001	Bay or estuary outfall	No	Secondary, Disinfected - 23	710	710	810	0
						Total	83,250	72,820	810	0

NOTES:
(1) A small volume of the discharged wastewater is treated to secondary disinfected 23 level for other purposes, including the recycled water truck-fill stations.
(2) Mel Leong Treatment Plant serves the San Francisco International Airpot (SFO). Volumes for 2015 are not readily available, so are based on an estimated 0.63 mgd in 2011 as provided in its NPDES permit, accessed at: http://www.waterboards.ca.gov/rwqcb2/board_decisions/adopted_orders/2013/R2-2013-0011.pdf.
Up to 0.72 mgd can be diverted to an onsite recycled water facility, which provides tertiary-treated recycled water for irrigation and other non-potable uses at SFO.

Table 6-3 Wholesale: Wastewater Treatment and Discharge Within Service Area in 2015										
☑	Wholesale supplier does not provide supplemental treatment to recycled water it distributes. The supplier will not complete the table below.									
							2015 volumes			
Wastewater Treatment Plant Name	Discharge Location Name or Identifier	Discharge Location Description	Wastewater Discharge ID Number *(optional)*	Method of Disposal *Drop down list*	Does This Plant Treat Wastewater Generated Outside the Service Area?	Treatment Level *Drop down list*	Wastewater Treated	Discharged Treated Wastewater	Recycled Within Service Area	Recycled Outside of Service Area
Add additional rows as needed										
						Total	0	0	0	0
NOTES:										

Table 6-4a Retail: Current and Projected Recycled Water Direct Beneficial Uses Within Service Area

☐	Recycled water is not used and is not planned for use within the service area of the supplier. The supplier will not complete the table below.							
Name of Agency Producing (Treating) the Recycled Water:		SFPUC						
Name of Agency Operating the Recycled Water Distribution System:		SFPUC						
Supplemental Water Added in 2015		0						
Source of 2015 Supplemental Water		Not applicable						
Beneficial Use Type *These are the only Use Types that will be recognized by the DWR online submittal tool*	General Description of 2015 Uses	Level of Treatment *Drop down list*	2015	2020	2025	2030	2035	2040 (opt)
Landscape irrigation (excludes golf courses)	Recycled water dispensed from truck-fill station for various approved uses (e.g., street tree irrigation, street cleaning, dust control). See note 1.	Secondary, Disinfected - 23	0	0	0	0	0	0
Landscape irrigation (excludes golf courses)	See note 2 for future uses.	Advanced	--	1,510	1,510	1,510	1,510	1,510
Golf course irrigation	See note 3 for future uses.	Advanced	--	270	270	270	270	270
Commercial use	See note 4 for future uses.	Secondary, Disinfected - 23	0	0	0	2,240	2,240	2,240
		Total:	0	1,780	1,780	4,020	4,020	4,020

IPR - Indirect Potable Reuse

NOTES:
(1) Recycled water use for landscape irrigation in 2015 reflects a very small amount of recycled water dispensed from the Southeast Water Pollution Control Plant recycled water truck-fill station for various approved uses, which were primarily public uses for street tree irrigation and street cleaning. Other uses for the recycled water dispensed by the truck-fill station include dust control, soil compaction, and sewer flushing.
(2) Recycled water use for landscape irrigation in the future reflects planned use at Golden Gate Park and non-golf portions of the Presidio served by the Westside Recycled Water Project.
(3) Recycled water use for golf course irrigation in the future reflects planned use at Lincoln Park Golf Course and Presidio Golf Course served by the Westside Recycled Water Project.
(4) Recycled water for commercial uses in the future reflects a mixture of non-potable uses by customers in the east side of San Francisco served by the Eastside Recycled Water Project.

Table 6-4b Retail: Current and Projected Recycled Water Direct Beneficial Uses Within Service Area

☐	Recycled water is not used and is not planned for use within the service area of the supplier. The supplier will not complete the table below.							
Name of Agency Producing (Treating) the Recycled Water:		North San Mateo County Sanitation District						
Name of Agency Operating the Recycled Water Distribution System:		North San Mateo County Sanitation District (portion of tranmission line within the City and County of San Francisco is operated by SFPUC)						
Supplemental Water Added in 2015		0						
Source of 2015 Supplemental Water		Not applicable						
Beneficial Use Type *These are the only Use Types that will be recognized by the DWR online submittal tool*	General Description of 2015 Uses	Level of Treatment *Drop down list*	2015	2020	2025	2030	2035	2040 (opt)
Golf course irrigation	Harding Park and Fleming Golf Courses	Tertiary	270	260	260	260	260	260
		Total:	270	260	260	260	260	260

IPR - Indirect Potable Reuse

NOTES: Recycled water use for landscape irrigation in 2015 and the future reflects use at Harding Park and Fleming Golf Courses served by the Harding Park Recycled Water Project.

Table 6-4c Retail: Current and Projected Recycled Water Direct Beneficial Uses Within Service Area

☐	Recycled water is not used and is not planned for use within the service area of the supplier. The supplier will not complete the table below.							
Name of Agency Producing (Treating) the Recycled Water:		North Coast County Water District						
Name of Agency Operating the Recycled Water Distribution System:		North Coast County Water District						
Supplemental Water Added in 2015		0						
Source of 2015 Supplemental Water		Not applicable						
Beneficial Use Type *These are the only Use Types that will be recognized by the DWR online submittal tool*	General Description of 2015 Uses	Level of Treatment *Drop down list*	2015	2020	2025	2030	2035	2040 (opt)
Golf course irrigation	Sharp Park Golf Course	Tertiary	10	90	90	90	90	90
		Total:	10	90	90	90	90	90

IPR - Indirect Potable Reuse

NOTES: Recycled water use for golf course irrigation in 2015 and the future reflects use at Sharp Park Golf Course served by the Pacifica Recycled Water Project. Recycled water delivery to the eastern portion of the golf course began in October 2014.

Table 6-4 Wholesale: Current and Projected Retailers Provided Recycled Water Within Service Area							
☑	Recycled water is not directly treated or distributed by the supplier. The supplier will not complete the table below.						
Name of Receiving Supplier or Direct Use by Wholesaler	Level of Treatment *Drop down list*	2015	2020	2025	2030	2035	2040 *(opt)*
	Total:	0	0	0	0	0	0
** This may include use outside the the UWMP area that is NOT included in another UWMP area. It is to be noted in the general description cell.*							
NOTES:							

Table 6-5 Retail: 2010 UWMP Recycled Water Use Projection Compared to 2015 Actual			
☐	Recycled water was not used in 2010 nor projected for use in 2015. The supplier will not complete the table below.		
Use Type *These are the only Use Types that will be recognized by the WUEdata online submittal tool*		2010 Projection for 2015	2015 actual use
Agricultural irrigation			
Landscape irrigation (exc golf courses)			
Golf course irrigation		340	280
Commercial use			
Industrial use			
Geothermal and other energy production			
Seawater intrusion barrier			
Recreational impoundment			
Wetlands or wildlife habitat			
Groundwater recharge (IPR)			
Surface water augmentation (IPR)			
Direct potable reuse			
Other	*Type of Use*		
	Total	**340**	**280**

NOTES:
Recycled water use for golf course irrigation in 2015, both projected and actual use, reflects use at Harding Park, Fleming, and Sharp Park Golf Courses.

Table 6-5 Wholesale: 2010 UWMP Recycled Water Use Projection Compared to 2015 Actual		
☑	Recycled water was not used or distributed by the supplier in 2010, nor projected for use or distribution in 2015. The wholesale supplier will not complete the table below.	
Name of Receiving Supplier or Direct Use by Wholesaler	2010 Projection for 2015	2015 actual use
Total	0	0
NOTES:		

Table 6-6 Retail: Methods to Expand Future Recycled Water Use			
Name of Action	Description	Planned Implementation Year	Expected Increase in Recycled Water Use
Non-potable Water Program (Mandatory Onsite Reuse)	Amendment to Non-potable Water Ordinance requiring new large construction in designated recycled water use area in San Francisco to install onsite water reuse systems starting November 2015. Requirements will apply to new large construction Citywide starting November 2016.	2015-2016	Up to 450
Westside Recycled Water Project	Construction of a Recycled Water Treatment Plant at the Oceanside Water Pollution Control Plant to serve recycled water for landscape irrigation at Golden Gate Park, Lincoln Park Golf Course, Presidio Golf Course, and other irrigated areas in the Presidio.	2019	Up to 2,240
Eastside Recycled Water Project	This project would consists of treatment, storage, and delivery of up to 2 mgd, annual average, of high-quality recycled water to a variety of customers on the east side of the City for non-potable irrigation, commercial, and industrial uses.	2030	Up to 2,240
Pacifica Recycled Water Project	Extension of recycled water irrigation system to the west side of Sharp Park Golf Course.	To be determined	90
Daly City Recycled Water Expansion	This project would add a new tertiary treatment facility located at the Daly City wastewater treatment plant to increase recycled water treatment capacity to up to 3.4 mgd. Currently, flows that exceed the capacity of the existing treatment plant are discharged into the Pacific Ocean. Through this project, some of the discharge may be used beneficially.	2022	Up to 3,810
Ordinances, Programs, and Services	The SFPUC administers or helps to administer various ordinances, programs, and services in the City related to recycled water and water reuse. The majority of these ordinances, programs, and services have been established for many years and are ongoing, resulting in increased water reuse. These include Soil Compaction and Dust Control Ordinance, Recycled Water Ordinance, Recycled Water Truck-Fill Station, and Large Landscape Grant Program.	2022	Estimate not available
		Total	**N/A**

Notes:
See UWMP Section 6.2.2 for more information.

Table 6-7 Retail: Expected Future Water Supply Projects or Programs						
☐	No expected future water supply projects or programs that provide a quantifiable increase to the agency's water supply. Supplier will not complete the table below.					
☐	Some or all of the supplier's future water supply projects or programs are not compatible with this table and are described in a narrative format.					
Page 6-15	Provide page location of narrative in the UWMP					
Name of Future Projects or Programs	Joint Project with other agencies? *Drop Down List*		Description (if needed)	Planned Implementation Year	Planned for Use in Year Type *Drop Down List* *User may select more than one*	Expected Increase in Water Supply to Agency
San Francisco Groundwater Supply Project [1]	No	--	Groundwater for potable supply.	2017-2020	Average Year Single-Dry Year Multi-Dry Year	3,140
Pacifica Recycled Water Project	Yes	North Coast County Water District	Extension of recycled water irrigation system to the west side of Sharp Park Golf Course.	To be determined	Average Year Single-Dry Year Multi-Dry Year	90
Westside Recycled Water Project	No	--	--	2019	Average Year Single-Dry Year Multi-Dry Year	Up to 2,240
Eastside Recycled Water Project	No		Treatment, storage, and delivery of up to 2 mgd of high-quality recycled water to a variety of customers on the east side of the City for non-potable irrigation, commercial, and industrial uses.	2030	Average Year Single-Dry Year Multi-Dry Year	Up to 2,240

NOTES:
(1) The San Francisco Groundwater Supply Project would yield a total of 4.0 MGD (4,480 AF); about 1.2 MGD (1,340 AF) of which is existing supply for non-potable use that would be converted for potable use, and the remaining 2.8 MGD (3,140 AF) is considered net new supply. Phase 1 would be completed in 2017, and Phase 2 would be completed in 2020.

Table 6-7 Wholesale: Expected Future Water Supply Projects or Programs							
☐	No expected future water supply projects or programs that provide a quantifiable increase to the agency's water supply. Supplier will not complete the table below.						
☑	Some or all of the supplier's future water supply projects or programs are not compatible with this table and are described in a narrative format. LOCATION OF THE NARRATIVE: Sections 6.2.2 and 7.2						
Name of Future Projects or Programs	Joint Project with other agencies?		Description *(if needed)*	Planned Implementation Year	Planned for Use in Year Type *Drop Down Menu U ser may select more than one*	Expected Increase in Water Supply to Agency	
	Drop Down Menu						
NOTES:							

Table 6-8 Retail: Water Supplies — Actual				
Water Supply *Drop down list* *May use each category multiple times. These are the only water supply categories that will be recognized by the WUEdata online submittal tool*	Additional Detail on Water Supply	2015		
		Actual Volume	Water Quality *Drop Down List*	Total Right or Safe Yield *(optional)*
Surface water		75,460	Drinking Water	
Groundwater		2,450	Raw Water	
Recycled Water	Recycled water dispensed from truck-fill station for various approved uses (e.g., street tree irrigation, street cleaning, dust control)	0	Recycled Water	
Purchased or Imported Water	Recycled water produced by North San Mateo County Sanitation District to serve Harding Park	270	Recycled Water	
Purchased or Imported Water	Recycled water produced by North Coast County Water District to serve Sharp Park	10	Recycled Water	
Total		78,190		-

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore reported in Table 6-8 Wholesale instead of this table. However, the corresponding retail table in the UWMP includes Groveland CSD.

Table 6-8 Wholesale: Water Supplies — Actual				
Water Supply *Drop down list* *May use each category multiple times. These are the only water supply categories that will be recognized by the WUEdata online submittal tool*	Additional Detail on Water Supply	2015		
		Actual Volume	Water Quality *Drop Down List*	Total Right or Safe Yield *(optional)*
Surface water		143,790	Drinking Water	
	Total	143,790		0

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is included in this table. However, the corresponding wholesale table in the UWMP excludes Groveland CSD.

Table 6-9 Retail: Water Supplies — Projected

Water Supply *Drop down list* *May use each category multiple times.* *These are the only water supply categories that will be recognized by the WUEdata online submittal tool*	Additional Detail on Water Supply	Projected Water Supply *Report To the Extent Practicable*									
		2020		**2025**		**2030**		**2035**		**2040** *(opt)*	
		Reasonably Available Volume	Total Right or Safe Yield *(optional)*	Reasonably Available Volume	Total Right or Safe Yield *(optional)*	Reasonably Available Volume	Total Right or Safe Yield *(optional)*	Reasonably Available Volume	Total Right or Safe Yield *(optional)*	Reasonably Available Volume	Total Right or Safe Yield *(optional)*
Surface water		78,510		80,190		81,650		85,680		90,160	
Groundwater	See Table 6-1 Retail for groundwater sources	5,600		5,600		5,600		5,600		5,600	
Recycled Water	See Table 6-4 Retail for groundwater sources	2,130		2,130		4,370		4,370		4,370	
	Total	86,240	-	87,920	-	91,620	-	95,650	-	100,130	-

NOTES:
Per DWR direction, Groveland CSD is reported as a wholesale customer in all standardized tables. As such, their supply projections are included in Table 6-9 Wholesale. Also per DWR direction, onsite non-potable water supplies produced in compliance with the Non-potable Water Ordinance cannot be reported in the standardized tables. Therefore, although non-potable supplies are included in the corresponding table in the UWMP, the equivalent quantity is included in this table as surface water (i.e., Regional Water System) supplies in lieu of non-potable water supplies.

Table 6-9 Wholesale: Water Supplies — Projected

Water Supply *Drop down list* *May use each category multiple times.* *These are the only water supply categories that will be recognized by the WUEdata online submittal tool*	Additional Detail on Water Supply	Projected Water Supply *Report To the Extent Practicable*									
		2020		2025		2030		2035		2040 *(opt)*	
		Reasonably Available Volume	Total Right or Safe Yield *(optional)*	Reasonably Available Volume	Total Right or Safe Yield *(optional)*	Reasonably Available Volume	Total Right or Safe Yield *(optional)*	Reasonably Available Volume	Total Right or Safe Yield *(optional)*	Reasonably Available Volume	Total Right or Safe Yield *(optional)*
Surface water	Bay Area Wholesale Customers	206,640		206,640		206,640		206,640		206,640	
	Total	206,640	0	206,640	0	206,640	0	206,640	0	206,640	0

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer in all the standardized tables. Their supply projections are included in this table.

Table 7-1 Retail: Bases of Water Year Data			
Year Type	**Base Year** *If not using a calendar year, type in the last year of the fiscal, water year, or range of years, for example, water year 1999-2000, use 2000*	**Available Supplies if Year Type Repeats**	
		☑ Quantification of available supplies is not compatible with this table and is provided elsewhere in the UWMP. Location UWMP Tables 7-1 and 8-2	
		☐ Quantification of available supplies is provided in this table as either volume only, percent only, or both.	
		Volume Available	**% of Average Supply**
Average Year			
Single-Dry Year			
Multiple-Dry Years 1st Year			
Multiple-Dry Years 2nd Year			
Multiple-Dry Years 3rd Year			
NOTES:			

Table 7-1 Wholesale: Bases of Water Year Data			
Year Type	Base Year	Available Supplies if Year Type Repeats	
		☑	Quantification of available supplies is not compatible with this table and is provided elsewhere in the UWMP. Location UWMP Tables 7-1 and 8-5
		☐	Quantification of available supplies is provided in this table as either volume only, percent only, or both.
Average Year			
Single-Dry Year			
Multiple-Dry Years 1st Year			
Multiple-Dry Years 2nd Year			
Multiple-Dry Years 3rd Year			
Agency may add rows for Multiple-Dry Years up to 5th year (optional)			
Agency may use multiple tables if reporting different water sources separately.			

Table 7-2 Retail: Normal Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040 *(Opt)*
Supply totals *(autofill fm Table 6-9)*	86,240	87,920	91,620	95,650	100,130
Demand totals *(autofill fm Table 4-3)*	86,240	87,920	91,620	95,650	100,130
Difference	0	0	0	0	0
NOTES: Per DWR direction, Groveland CSD is reported as a wholesale customer in the standardized tables. Their supplies and demands are included in Table 7-2 Wholesale.					

Table 7-2 Wholesale: Normal Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040 *(Opt)*
Supply totals *(autofill fm Table 6-9)*	206,640	206,640	206,640	206,640	206,640
Demand totals *(autofill fm Table 4-3)*	206,640	206,640	206,640	206,640	206,640
Difference	0	0	0	0	0

NOTES:
Per DWR direction, Groveland CSD is reported as a wholesale customer in the standardized tables. Their supplies and demands are included in this table.

Table 7-3 Retail: Single Dry Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040 (Opt)
Supply totals	86,240	87,920	91,620	95,650	100,130
Demand totals	86,240	87,920	91,620	95,650	100,130
Difference	0	0	0	0	0

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore included in Table 7-3 Wholesale.

Table 7-3 Wholesale: Single Dry Year Supply and Demand Comparison					
	2020	2025	2030	2035	2040 (Opt)
Supply totals	171,470	171,470	171,470	171,470	171,470
Demand totals	206,640	206,640	206,640	206,640	206,640
Difference	(35,170)	(35,170)	(35,170)	(35,170)	(35,170)

NOTES:
Groveland CSD is accounted for as a wholesale customer and is included in this table.

Table 7-4 Retail: Multiple Dry Years Supply and Demand Comparison						
		2020	2025	2030	2035	2040 (Opt)
First year	Supply totals	86,240	87,920	91,620	95,650	100,130
	Demand totals	86,240	87,920	91,620	95,650	100,130
	Difference	0	0	0	0	0
Second year	Supply totals	86,240	87,920	91,620	95,650	98,900
	Demand totals	86,240	87,920	91,620	95,650	100,130
	Difference	0	0	0	0	(1,230)
Third year	Supply totals	86,240	87,920	91,620	95,650	98,900
	Demand totals	86,240	87,920	91,620	95,650	100,130
	Difference	0	0	0	0	(1,230)

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore reported in Table 7-4 Wholesale instead of this table. However, the corresponding retail table in the UWMP includes Groveland CSD.
Also per DWR direction, onsite non-potable water supplies produced in compliance with the Non-potable Water Ordinance cannot be reported in the standardized tables. Therefore, although non-potable supplies are included in the corresponding table in the UWMP, the equivalent quantity is included in this table as surface water (i.e., Regional Water System) supplies in lieu of non-potable water supplies.

Table 7-4 Wholesale: Multiple Dry Years Supply and Demand Comparison						
		2020	2025	2030	2035	2040 (Opt)
First year	Supply totals	171,470	171,470	171,470	171,470	171,470
	Demand totals	206,640	206,640	206,640	206,640	206,640
	Difference	(35,170)	(35,170)	(35,170)	(35,170)	(35,170)
Second year	Supply totals	148,960	148,960	148,960	148,960	148,960
	Demand totals	206,640	206,640	206,640	206,640	206,640
	Difference	(57,680)	(57,680)	(57,680)	(57,680)	(57,680)
Third year	Supply totals	148,960	148,960	148,960	148,960	148,960
	Demand totals	206,640	206,640	206,640	206,640	206,640
	Difference	(57,680)	(57,680)	(57,680)	(57,680)	(57,680)

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is included in this table. However, the corresponding wholesale table in the UWMP excludes Groveland CSD.

Table 8-1 Retail Stages of Water Shortage Contingency Plan		
	Complete Both	
Stage	Percent Supply Reduction[1] *Numerical value as a percent*	Water Supply Condition (*Narrative description)*
1	*10-20%*	*10% Reduction in System Supply*
2	21-50%	*21-50% Reduction in System Supply*
3	> 50%	*Over 50% Reduction in System Supply*
[1] *One stage in the Water Shortage Contingency Plan must address a water shortage of 50%.*		
NOTES:		

Table 8-1 Wholesale: Stages of Water Shortage Contingency Plan

Stage	Complete Both	
	Percent Supply Reduction[1]	Water Supply Condition
1	*12%*	*5% or less system-wide reduction*
2	*17%*	6-10% system-wide reduction
3	*23%*	11-15% system-wide reduction
4	*28%*	16-20% system-wide reduction
N/A	*55%*	50% system-wide reduction

[1] *One stage in the WSCP must address a water shortage of 50%.*

NOTES: The Water Shortage Allocation Plan (WSAP) does not have a stage specific to a water supply reduction condition of 50%. This condition is addressed narratively in Section 2.3 of the WSAP, which describes actions to be taken by the SFPUC and its wholesale customers if system-wide shortage exceeds stage 4.

Table 8-2 Retail Only: Restrictions and Prohibitions on End Uses

Stage	Restrictions and Prohibitions on End Users *Drop down list* *These are the only categories that will be accepted by the WUEdata online submittal tool*	Additional Explanation or Reference *(optional)*	Penalty, Charge, or Other Enforcement? *Drop Down List*
See notes	Landscape - Restrict or prohibit runoff from landscape irrigation	"Water waste, including but not limited to, any flooding or runoff into the street, sidewalk or gutter"	Yes
See notes	Other - Require automatic shut of hoses	"Using hoses for any purpose without a positive shut-off valve"	Yes
See notes	CII - Restaurants may only serve water upon request	"Serving water at a restaurant, café, or food counter without waiting for a request by a customer or customers"	Yes
See notes	Water Features - Restrict water use for decorative water features, such as fountains	"Potable water was not to be used to clean, fill or maintain levels in decorative fountains"	Yes
See notes	Other - Prohibit use of potable water for construction and dust control	"Use of potable water for consolidation of backfill, dust control or other nonessential construction purposes if groundwater or recycled water is available and approved by the San Francisco Department of Public Health"	Yes
See notes	CII - Other CII restriction or prohibition	"Use of single-pass cooling systems, fountains, and commercial car washes"	Yes
2, 3	Other - Prohibit use of potable water for washing hard surfaces	"Washing sidewalks, driveways, plazas and other outdoor hardscapes for reasons other than health and safety needs"	Yes
2, 3	Landscape - Prohibit certain types of landscape irrigation	"Outdoor irrigation of ornamental landscapes or turf with potable water that is not reduced by at least the amount (percentage) specified in the drought response plan"	Yes
2, 3	Landscape - Other landscape restriction or prohibition	"Watering outdoor landscapes with potable water during and within 48 hours after a rain event"	Yes
2, 3	CII - Lodging establishment must offer opt out of linen service	"Not providing guests the option to refuse daily laundering of towels and linens at hotels and motels, and not prominently displaying notice of this option in each guestroom"	Yes
2, 3	Landscape - Prohibit certain types of landscape irrigation	"Irrigation with potable water of ornamental turf on public street medians"	Yes
2, 3	Landscape - Prohibit certain types of landscape irrigation	"Use of additional water for new landscaping or expansion of existing facilities unless low water use landscaping designs and irrigation systems are employed"	Yes
2, 3	Other	"Water service connections for new construction not incorporating water-saving fixtures or devices into the plumbing system"	Yes
2, 3	Other	"Verified water waste as determined by the Water Department would serve as prima facie evidence that the allocation assigned to the water account is excessive; therefore, the allocation was subject to review and possible reduction, including termination of serviced"	Yes
2, 3	Landscape - Prohibit certain types of landscape irrigation	"Use of supplies other than groundwater and/or recycled water for irrigation of golf courses, median strips, and similar turf areas"	Yes
2, 3	Landscape - Prohibit certain types of landscape irrigation	"Use of potable water on golf courses outside irrigation of putting greens"	Yes
2, 3	Other - Prohibit use of potable water for washing hard surfaces	"Use of potable water for street sweepers/washers"	Yes
2, 3	Other - Prohibit vehicle washing except at facilities using recycled or recirculating water	"The washing of all automobiles, motorcycles, RVS, trucks, transit vehicles, trailers, boats, trains, and airplanes outside of a commercial washing facility; unless required to clean windows on all vehicles and such commercial or safety vehicles for health and safety reasons"	Yes
2, 3	Other water feature or swimming pool restriction	"The filling of new swimming pools, spas, hot tubs, or the draining and refilling of existing pools, etc."	Yes

NOTES:
Permanent restriction or prohibition in place regardless of water shortage.

Table 8-3 Retail Only: Stages of WSCP - Consumption Reduction Methods		
Stage	Consumption Reduction Methods by Water Supplier *Drop down list* *These ore the only categories thot will be occepted by the WUEdoto online submittol tool*	Additional Explanation or Reference *(optional)*
	Expand Public Information Campaign	See UWMP Section 8.3.1.4 for details
	Improve Customer Billing	See UWMP Section 8.3.1.4 for details
	Increase Frequency of Meter Reading	See UWMP Section 8.3.1.4 for details
	Offer Water Use Surveys	See UWMP Section 8.3.1.4 for details
	Provide Rebates on Plumbing Fixtures and Devices	See UWMP Section 8.3.1.4 for details
	Provide Rebates for Landscape Irrigation Efficiency	See UWMP Section 8.3.1.4 for details
	Provide Rebates for Turf Replacement	See UWMP Section 8.3.1.4 for details
	Decrease Line Flushing	See UWMP Section 8.3.1.4 for details
	Reduce System Water Loss	See UWMP Section 8.3.1.4 for details
	Increase Water Waste Patrols	See UWMP Section 8.3.1.4 for details
	Implement or Modify Drought Rate Structure or Surcharge	See UWMP Section 8.3.1.4 for details
	Other	See UWMP Section 8.3.1.4 for details

NOTES:
The listed consumption reduction methods are implemented on a continuous basis, regardless of water shortage. However, mandatory rationing with corresponding allocations and excess use charges (i.e., "Implement or Modify Drought Rate Stucture or Surcharge") is the only method that may be implemented in response to a shortage.

Table 8-4 Retail: Minimum Supply Next Three Years			
	2016	2017	2018
Available Water Supply	92,850	88,930	88,930

NOTES:
Per DWR direction, Groveland CSD is not included in this table as it needs to be accounted for as a wholesale customer. Supplies to Groveland CSD are included in Table 8-4 Wholesale.

Table 8-4 Wholesale: Minimum Supply Next Three Years			
	2016	2017	2018
Available Water Supply	171,810	145,260	145,260

NOTES:
Per DWR direction, Groveland CSD is included in this table as a wholesale customer.

Table 10-1 Retail: Notification to Cities and Counties		
City Name	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
San Francisco	☑	☑
	☐	☐
	☐	☐
County Name *Drop Down List*	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
Alameda County	☑	☑
San Mateo County	☑	☑
Santa Clara County	☑	☑
San Joaquin County	☑	☑
	☐	☐

NOTES:
In addition to the cities and counties listed above, the SFPUC also notified various private organizations and communities that may be interested in participating in the UWMP process. A complete list of these entities can be found in Appendix C.

Table 10-1 Wholesale: Notification to Cities and Counties (select one)		
☑	Supplier has notified more than 10 cities or counties in accordance with CWC 10621 (b) and 10642. **Completion of the table below is not required. Provide a separate list of the cities and counties that were notified.**	
Appendix C	Provide the page or location of this list in the UWMP.	
☐	Supplier has notified 10 or fewer cities or counties. **Complete the table below.**	
City Name	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
	☐	☐
	☐	☐
	☐	☐
County Name *Drop Down List*	60 Day Notice	Notice of Public Hearing
Add additional rows as needed		
	☐	☐
	☐	☐
	☐	☐
NOTES:		

APPENDIX C

Evidence of Compliance with Outreach Requirements

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

Summary Table of SFPUC Compliance with
Public Notification Elements of the Urban Water Management Plan Act

Note: Actions and documentation denoted with an asterisk (*) are not yet completed or available as of the publication of the Draft 2015 UWMP, but will be provided in the 2015 UWMP submitted to the Commission for adoption and to DWR, or will otherwise be retained on file.

Code Section	Code Requirement	Summary of Action Taken	Documentation (Attached after this Table)
Water Code Section 10620	Notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes.	✓ January 29 and March 7, 2016: Sent notification letters via email to City agencies, wholesale customers of the SFPUC Regional Water System, suburban retail customers (e.g., SFO), large regional water agencies (e.g., EBMUD), Bay Area Water Supply Conservation Agency (BAWSCA), and a larger distribution list of parties known by the SFPUC to be interested in water resources planning issues. ✓ April 14, 2016: Sent emails to all parties listed above regarding the availability of the Draft 2015 UWMP.	• Example of 1/29/16 letter sent via email (same letter sent via email on 3/7/16 to additional recipients) • Example of 4/14/16 email* • Recipient list
Water Code Section 10642	Encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan.	✓ January 29 and March 7, 2016: Sent emails to a larger distribution list of parties known by the SFPUC to be interested in water resources planning issues. ✓ April 14, 2016: Posted the Draft 2015 UWMP on the SFPUC website at www.sfwater.org ✓ April 25 and May 2, 2016: Posted advertisement in local community newspaper(s) in English, Chinese, Spanish, and Filipino regarding the availability of the Draft 2015 UWMP, as well as the time and location of the public hearing.*	• Example of 1/29/16 letter sent via email (same letter sent via email on 3/7/16 to additional recipients) • Copy of web posting* • Declaration of publication of San Francisco Examiner and copy of advertisement*
Water Code Section 10642	Prior to the required hearing, publish the notice of time and place of hearing within the jurisdiction of the supplier pursuant to Section 6066 of the Government Code.	✓ April 25 and May 2, 2016: Posted Notification of Public Hearing in local community newspaper meeting requirement of Section 6066 of the Government Code.*	• Declaration of publication in San Francisco Examiner and copy of advertisement*

Code Section	Code Requirement	Summary of Action Taken	Documentation (Attached after this Table)
Water Code Section 10642	Prior to the required hearing, provide notice of time and place of hearing to any city of county within which the supplier provides water.	✓ January 29 and March 7, 2016: Provided notification of public hearing, including time and place of the hearing, in the same notification letter regarding the preparation of the 2015 UWMP Update.	• Example of 1/29/16 letter sent via email (see page 2 for notification of public hearing; same letter sent via email on 3/7/16 to additional recipients) • Recipient list
Water Code Section 10642	Prior to adoption, make the plan available for public inspection.	✓ April 14, 2016: Posted the Draft 2015 UWMP on the SFPUC website at www.sfwater.org ✓ April 14, 2016: Hand delivered two copies of the Draft 2015 UWMP to the San Francisco Main Library.	• Copy of web posting* • Copy of delivery confirmation to the San Francisco Public Library*
Water Code Section 10642	Prior to adoption, hold a public hearing.	✓ May 10, 2016: Held public hearing during the meeting of the San Francisco Public Utilities Commission.*	• Copy of Commission Meeting Agenda including public hearing*
Water Code Section 10642	After the hearing, the plan shall be adopted as prepared or as modified after the meeting.	✓ June 14, 2016: Adopted the SFPUC 2015 UWMP (as amended) during the meeting of the San Francisco Public Utilities Commission.*	• Copy of Resolution to Adopt the 2015 UWMP*
Water Code Section 10644(a)	Within 30 days of plan adoption, submit a copy to DWR.	✓ By July 1, 2016 (exact date to be determined): Mailed a copy of the adopted 2015 UWMP to the DWR, and also submitted the document electronically via the WUEdata Online Submittal Tool.*	• *On file with the SFPUC:* Copy of delivery confirmation to DWR* • *On file with the SFPUC:* Copy of DWR submittal confirmation*
Water Code Section 10644(a)	Within 30 days of plan adoption, submit a copy to the CA State Library.	✓ By July 14, 2016 (exact date to be determined): Mailed a copy of the adopted 2015 UWMP to the California State Library.*	• *On file with the SFPUC:* Copy of delivery confirmation to the California State Library*
Water Code Section 10644(a)	Within 30 days of plan adoption, submit a copy to any city or county within which the supplier provides water.	✓ By July 14, 2016 (exact date to be determined): Emailed the adopted 2015 UWMP to all wholesale customers of the SFPUC Regional Water System, and cities or counties within which the SFPUC provides water.*	• *On file with the SFPUC:* Copy of 7/14/16 email (exact date to be determined)*

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

525 Golden Gate Avenue, 10th Floor
San Francisco, CA 94102
T 415.554.3271
F 415.934.5770
TTY 415.554.3488

January 29, 2016

Subject: **Notification of the City and County of San Francisco Urban Water Management Plan 2015 Update and Public Hearing**

The Urban Water Management Planning Act (Water Code Section 10610-10657) requires each urban water supplier to update its Urban Water Management Plan (UWMP) and submit the completed plan to the California Department of Water Resources (DWR) every 5 years. The City and County of San Francisco is currently reviewing its 2010 UWMP and will be considering amendments or changes to the document. We invite your agency's or organization's participation in this process.

State law requires that, at least 60 days prior to the public hearing, the City and County of San Francisco provide notice to any city and county within which it provides water supplies that it intends to update the UWMP. This letter serves as the required notification.

The UWMP will provide an overview of our water deliveries and uses, water supply sources, and water conservation programs. It will also include discussions on supply and demand projections over a 25-year planning horizon (from 2015 to 2040), available water supplies to meet existing and future demands under a range of water supply conditions, and our water demand management measures to reduce long-term water demand.

Proposed revisions to the UWMP will be available for public review and comment starting mid-April 2016. The Draft UWMP 2015 Update will be available on the SFPUC website at www.sfwater.org (enter "UWMP" in the search field located in the upper right hand corner of the homepage). A copy of the document will also be available for review at the San Francisco Public Library:

San Francisco Public Library
Government Information Center, 5th Floor
100 Larkin Street
San Francisco, CA 94102
(415) 557-4400

Notice of Public Hearing

A public hearing will be held on May 10, 2016 to allow interested members of the public to participate in the review process. The hearing will be held at the Commission meeting which begins at 1:30 p.m. in City Hall, Room 400, 1 Dr. Carlton B. Goodlett Place, San Francisco, California. All interested parties are invited to attend the public hearing and present their views. Persons who are unable to attend the public hearing may also submit to the City, by the time the proceedings begin, written comments regarding the subject of the hearing. These comments will be brought to the attention of the Commission and will become part of the official public record. Written comments can be sent to:

Donna Hood
Commission Secretary
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 13th Floor
San Francisco, CA 94102

In the meantime, if you have any questions about our UWMP, or the process of updating it, please contact:

Fan Lau
Water Resources Specialist
San Francisco Public Utilities Commission
525 Golden Gate Avenue, 10th Floor
San Francisco, CA 94102
(415) 554-2498
FLau@sfwater.org

Sincerely,

Paula Kehoe

Paula Kehoe
Director of Water Resources

Recipients of 2015 UWMP Update Notification
(sent via e-mail on January 29, 2016 and March 7, 2016)

NO.	ORGANIZATION	CONTACT
1	City College of San Francisco	Robert Gabriner
2	Mayor's Office of Neighborhood Services	David Miree
3	Port of San Francisco	Monique Moyer
4	San Francisco Board of Supervisors	Aaron Peskin
5	San Francisco Board of Supervisors	David Campos
6	San Francisco Board of Supervisors	Eric Mar
7	San Francisco Board of Supervisors	Jane Kim
8	San Francisco Board of Supervisors	John Avalos
9	San Francisco Board of Supervisors	Katy Tang
10	San Francisco Board of Supervisors	London Breed
11	San Francisco Board of Supervisors	Malia Cohen
12	San Francisco Board of Supervisors	Mark Farrell
13	San Francisco Board of Supervisors	Norman Yee
14	San Francisco Board of Supervisors	Scott Wiener
15	San Francisco Department of Building Inspection	Lily Madjus-Wu
16	San Francisco Department of Building Inspection	Tom Hui
17	San Francisco Department of Public Health	Barbara Garcia
18	San Francisco Department of Public Works	Mohammed Nuru
19	San Francisco Department of the Environment	Debbie Raphael
20	San Francisco Fire Department	Joanne Hayes-White
21	San Francisco International Airport	John Martin
22	San Francisco International Airport	Mark Costanzo
23	San Francisco Municipal Transportation Agency	Edward Reiskin
24	San Francisco Office of Community Investment and Infrastructure	Darshan Singh
25	San Francisco Office of Community Investment and Infrastructure	Tiffany Bohee
26	San Francisco Office of Small Business	Regina Dick-Endrizzi
27	San Francisco Office of the City Attorney	Dennis Herrera
28	San Francisco Planning Department	Gil Kelley
29	San Francisco Planning Department	John Rahaim
30	San Francisco Planning Department	Sarah B. Jones
31	San Francisco Public Library	Luis Herrera
32	San Francisco Recreation and Park Department	Dennis Kern
33	San Francisco Recreation and Park Department	Phil Ginsburg
34	San Francisco Sheriff's Department	Vicki L. Hennessy
35	SFPUC Citizens' Advisory Committee (CAC)	Amy Zock
36	SFPUC Citizens' Advisory Committee (CAC)	Art Taylor
37	SFPUC Citizens' Advisory Committee (CAC)	Avni Jamdar
38	SFPUC Citizens' Advisory Committee (CAC)	Eli Saddler
39	SFPUC Citizens' Advisory Committee (CAC)	Jennifer Clary
40	SFPUC Citizens' Advisory Committee (CAC)	Kelly Groth
41	SFPUC Citizens' Advisory Committee (CAC)	Marjorie Goodwin
42	SFPUC Citizens' Advisory Committee (CAC)	Mark Connors
43	SFPUC Citizens' Advisory Committee (CAC)	Rebecca Lee
44	SFPUC Citizens' Advisory Committee (CAC)	Shalini Swaroop
45	SFPUC Citizens' Advisory Committee (CAC)	Suki Kott
46	SFPUC Citizens' Advisory Committee (CAC)	Tamar Barlev
47	SFPUC Citizens' Advisory Committee (CAC)	Ted Loewenberg
48	SFPUC Citizens' Advisory Committee (CAC)	Tracy Zhu

Recipients of 2015 UWMP Update Notification
(sent via e-mail on January 29, 2016 and March 7, 2016)

NO.	ORGANIZATION	CONTACT
49	SFPUC Citizens' Advisory Committee (CAC)	Wendolyn Aragon
50	Sunshine Ordinance Task Force	Louise Fischer
51	Alameda County Water District	Doug Chun
52	Alameda County Water District	Robert Shaver
53	Alameda County Water District	Steven Inn
54	California Water Service Company	Darin Duncan
55	California Water Service Company	Dawn Smithson
56	California Water Service Company	Tony Carrasco
57	City of Brisbane	Jerry Flanagan
58	City of Brisbane/Guadalupe Valley Municipal Improvement District	Randy Breault
59	City of Burlingame	Art Morimoto
60	City of Burlingame	George J. Bagdon
61	City of Daly City	Patrick Sweetland
62	City of East Palo Alto	Carlos Martinez
63	City of East Palo Alto	Maziar Bozorginia
64	City of Hayward	Alex Ameri
65	City of Hayward	Corinne Ferreyra
66	City of Menlo Park	Pam Lowe
67	City of Menlo Park	Ruben Nino
68	City of Millbrae	Khee Lim
69	City of Millbrae	Peter Vorametsanti
70	City of Millbrae	Shelley Reider
71	City of Milpitas	Nina Hawk
72	City of Milpitas	Steven Machida
73	City of Mountain View	Elizabeth Flegel
74	City of Mountain View	Gregg Hosfeldt
75	City of Palo Alto	Jane Ratchye
76	City of Palo Alto	Karla Dailey
77	City of Redwood City, Public Works Services Department	Justin Chapel
78	City of Redwood City, Public Works Services Department	Melissa Stevenson Diaz
79	City of Redwood City, Public Works Services Department	Terrence Kyaw
80	City of San Bruno	Jim Burch
81	City of San Bruno	Jimmy Tan
82	City of San Jose	Jeff Provenzano
83	City of San Jose	Mansour Nasser
84	City of Santa Clara	Chris DeGroot
85	City of Santa Clara	Robin Saunders
86	City of Sunnyvale	James Craig
87	City of Sunnyvale	John Stufflebean
88	City of Sunnyvale	Mansour Nasser
89	Coastside County Water District	David Dickson
90	Cordilleras Water District	Rick Thall
91	East Palo Alto Water District	Anthony Docto
92	Estero Municipal Improvement District	Jeff Moneda
93	Groveland Community Service	Jon Sterling
94	Mid-Peninsula Water District	Rene Ramirez
95	Mid-Peninsula Water District	Tammy Rudock
96	North Coast County Water District	Cari Lemke

Recipients of 2015 UWMP Update Notification
(sent via e-mail on January 29, 2016 and March 7, 2016)

NO.	ORGANIZATION	CONTACT
97	Purissima Hills Water District	Patrick Walter
98	Stanford University	Julia Nussbaum
99	Town of Hillsborough	Paul Willis
100	Westborough Water District	Darryl Barrow
101	BAWSCA	Adrianne Carr
102	BAWSCA	Andree Johnson
103	BAWSCA	Christina Tang
104	BAWSCA	Michael Hurley
105	BAWSCA	Nicole Sandkulla
106	California State Assembly, AD12	Kristin Olsen
107	California State Coastal Conservancy	Matt Gerhart
108	California State Library Government Publications Section	Janet Coles
109	California State Seismic Safety Commission	Fred Turner
110	Department of Water Resources Office of Water Use Efficiency & Transfer	David Todd
111	U.S. EPA Region 9	David W. Smith
112	U.S. EPA Region 9	Dena Vallano
113	U.S. EPA Region 9	Nancy Woo
114	Contra Costa Water District	Jerry Brown
115	East Bay Municipal Utility District	Alexander Coate
116	East Bay Municipal Utility District	Priyanka Jain
117	Los Trancos County Water District	Stanley R. Gage
118	Marin Municipal Water District	Krishna Kumar
119	Santa Clara Valley Water District	Jim Fiedler
120	Santa Clara Valley Water District	Jerry De La Piedra
121	Zone 7 Water Agency	Jill Duerig
122	Zone 7 Water Agency	Amparo Flores
123	Turlock Irrigation District	Tou Her
124	County of San Mateo	Ed Garcia
125	Alameda County	Susan S. Muranishi
126	County of Santa Clara	Jeffrey V. Smith
127	San Joaquin County	Monica Nino
128	Tuolumne County	Craig Pedro
129	Castlewood Country Club	John Vest
130	Golden Gate National Cemetery	Bradley Phillips
131	Lawrence Livermore National Laboratory	Ellen Raber
132	Lawrence Livermore National Laboratory	Jackie Angell
133	Menlo Country Club	Christopher Robinson
134	National Park Service GGNRA	Allison Cryns
135	San Francisco State University	Barbara Holzman
136	San Francisco State University	Caitlin Steele
137	San Francisco State University	Charles A. Meyer
138	San Francisco State University	Davin Wentworth-Thrasher
139	San Francisco State University	Ryszard Dziadur
140	San Francisco Zoo	Tanya Peterson
141	The Villas Parkmerced	General e-mail address
142	American True / True Youth	Ward Latimer
143	Bay Area Water Stewards (BAWS)	Multiple members
144	Bayview Merchants Association	Al Norman

Recipients of 2015 UWMP Update Notification
(sent via e-mail on January 29, 2016 and March 7, 2016)

NO.	ORGANIZATION	CONTACT
145	California Native Plant Society - Yerba Buena Chapter	Ellen Edelson
146	California Trout	Curtis Knight
147	Coalition for a Better Wastewater Solution	Jeff Marmer
148	Coalition For San Francisco Neighborhoods	Joan Girardot
149	Golden Gate Audubon Society	Cindy Margulis
150	Golden Gate Audubon Society	Dan Murphy
151	Golden Gate Heights Neighborhood Association	Frank Noto
152	Golden Gate Restaurant Association	Gwyneth Borden
153	Greater West Portal Neighborhood Association	Avum Shepard
154	Greater West Portal Neighborhood Association	General e-mail address
155	Greater West Portal Neighborhood Association	Rae Doyle
156	Lakeshore Acres Improvement Club	Jim Stark
157	North of the Panhandle Neighborhood Association	Tim Hickey
158	Oceanview, Merced Heights, Ingleside - Neighbors in Action (OMI-NIA)	Al Harris
159	Oceanview, Merced Heights, Ingleside - Neighbors in Action (OMI-NIA)	Mary Harris
160	Pacific Institute	Heather Cooley
161	Pacific Institute	Peter Gleick
162	Planning Association for the Richmond (PAR)	Ray Holland
163	Planning Association for the Richmond (PAR)	Richard Corriea
164	Plumbers Union Local 38	Larry Mazzola Jr.
165	Restore Hetch Hetchy	Spreck Rosekrans
166	San Francisco Beautiful	Darcy Brown
167	San Francisco Chamber of Commerce	Bob Linscheid
168	San Francisco Chamber of Commerce	Dee Dee Workman
169	San Francisco Chamber of Commerce	Jim Lazarus
170	San Francisco Council of District Merchants	Stephen Cornell
171	San Francisco Democratic County Central Committee	Alexandra Medina
172	San Francisco Parks Alliance	Matthew O'Grady
173	San Francisco Parks Alliance	Rachel Norton
174	San Francisco Republican Central Committee	Mike Denunzio
175	San Francisco Republican County Central Committee	Christine Hughes
176	San Francisco Small Business Network	Pat Christensen
177	San Francisco Tomorrow	Jennifer Clary
178	San Francisco Tomorrow	Jennifer Clary
179	Sierra Club	Ruth Gravanis
180	Sierra Club, San Francisco Bay Chapter	Michelle Meyers
181	Small Business Network	Paul Pendergast
182	Southeast Community Facility	Toye Moses
183	SPUR	Laura Tam
184	Sunset Beacon/Richmond Review	Paul Kozakiewicz
185	Sunset Heights Associaton of Responsible People	J. Barry
186	Sunset Neighborhood Beacon Center	Matt Pemberton
187	Sunset Parkside Education and Action Committee (SPEAK)	Marc Duffet
188	Sunset Parkside Education and Action Committee (SPEAK)	Marc Duffett
189	Taraval Parkside Merchants Association	Yumi Sam
190	Tuolumne River Trust	Peter Drekmeier
191	Urban Resource Systems	Isabel Wade
192	West of Twin Peaks Central Council	Roger Ritter

Recipients of 2015 UWMP Update Notification
(sent via e-mail on January 29, 2016 and March 7, 2016)

NO.	ORGANIZATION	CONTACT
193	West of Twin Peaks Observer	Mitch Bull
194	Westwood Park Association	Kate Favetti
195	Presidio Trust	Craig Middleton
196	Presidio Trust	Mark Hurley
197	Presidio Trust	Paula R. Collins

This page intentionally left blank.

San Francisco
Water Power Sewer
Operator of the Hetch Hetchy Regional Water System

525 Golden Gate Avenue, 10th Floor
San Francisco, CA 94102
T 415.554.3271
F 415.934.5770
TTY 415.554.3488

January 5, 2016

Andree Johnson
Water Resources Specialist
Bay Area Water Supply and Conservation Agency
155 Bovet Road, Suite 650
San Mateo, CA 94402

Dear Ms. Johnson,

Attached please find the information you requested on the Regional Water System's supply reliability for use in the Wholesale Customer's 2015 Urban Water Management Plan (UWMP) updates. The SFPUC has assessed the water supply reliability under the following planning scenarios:

- Projected single dry year supply for base year 2015[1],
- Projected multiple dry year supply beginning with base year 2015, and
- Projected supply reliability for base year 2015 through 2040.

Table 1 summarizes deliveries to the Wholesale Customers for projected single dry year supply for base year 2015 and projected multiple dry year supply beginning base year 2015.

With regards to future demands, the SFPUC proposes to expand their water supply portfolio by increasing the types of water supply resources. Table 2 summarizes the water supply resources assumed to be available by 2040, as well as other assumptions affecting supply. These assumptions differ from those used in the reliability analysis for the previous 2010 UWMP update, and lead to slightly different reliability projections explained further below.

Concerning allocation of supply during dry years, the Water Shortage Allocation Plan (WSAP) was utilized to allocate shortages between the SFPUC and the Wholesale Customers collectively. The WSAP implements a method for allocating water between the SFPUC retail customers and wholesale customers collectively which has been adopted by the Wholesale Customers

[1] Fiscal Year 2015 is used as the base year to run the water supply reliability analysis in the Hetch Hetchy Local Simulation Model (HHLSM). This base year reflects a wholesale Supply Assurance of 184 million gallons per day, as well as Regional Water System reservoir and pipeline capacities and instream flow requirements as they exist in 2015 (pre-Water System Improvement Program [WSIP] completion).

per the July 2009 Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County, and Santa Clara County. The wholesale customers have adopted the Tier Two Plan, the second component of the WSAP, which allocates the collective wholesale customer share among each of the 26 wholesale customers.

Finally, the SFPUC estimated the frequency and severity of anticipated shortages for the period 2015 (base year) through 2040. For this analysis, we assumed that the historical hydrologic period is indicative of future events and evaluated the supply reliability assuming a repeat of the actual historic hydrologic period 1921 through 2011. The results of this analysis are summarized in Table 3.

Compared to the reliability projections that were provided previously for the 2010 UWMP update, Table 1 indicates slightly higher shortages and lower Wholesale allocations for dry years 2 and 3. Also, Table 3 shows slightly higher estimates of required rationing in multi-year droughts as compared to those provided previously. These differences are due to the inclusion of a temporary constraint on Crystal Springs Reservoir storage and an in-stream flow requirement below Crystal Springs Reservoir, which are shown in Table 2, but were not included in the previous reliability analysis.

It is our understanding that you will pass this information on to the Wholesale Customers. If you have any questions or need additional information, please do not hesitate to contact me at (415) 554-0792.

Sincerely,

Paula Kehoe

Paula Kehoe
Director of Water Resources

Table 1: Projected Deliveries for Three Multiple Dry Years

	Base Year 2015 (Non-Dry)	One Critical Dry Year	Deliveries During Multiple Dry Years		
			Year 1	Year 2	Year 3
System-Wide Shortage	0%	10%	10%	22%	22%
Wholesale Allocation (MGD)	184.0	152.6	152.6	129.2	129.2

MGD = million gallons per day

Table 2: Water Supply Modeling Assumptions for Fiscal Years 2015 through 2040

	2015	2020	2025	2030	2035	2040
Water Supply Resource						
Westside Basin Groundwater (AF/yr)		8,100	8,100	8,100	8,100	8,100
Districts Transfer (AF/yr)		2,240	2,240	2,240	2,240	2,240
Crystal Springs Reservoir Capacity (20.3 BG) [1]			x	x	x	x
Calaveras Reservoir at Full Capacity		x	x	x	x	x
Alameda Creek Recapture (9.3 MGD)		x	x	x	x	x
Reservoir Operation Affecting Supply						
Crystal Springs Reservoir Release for In-Stream Flow to San Mateo Creek (3.5 MGD) [2]	x	x	x	x	x	x
Calaveras Reservoir Release and Alameda Creek Diversion Dam Bypass for In-Stream Flow to Alameda Creek (9.3 MGD)		x	x	x	x	x

AF/yr = acre-feet per year, BG = billion gallons, MGD = million gallons per day, x = in operation

Notes:

1. Schedule for restoration of Crystal Springs Reservoir storage is tied to permitting requirements for endangered plants.
2. Release from Crystal Springs Reservoir to meet minimum in-stream flow requirement in San Mateo Creek began in January 2015.

Table 3: Projected System Supply Reliability Based on Hydrologic Period

	Wholesale Demand (MGD)					
	184.0	184.0	184.0	184.0	184.0	184.0
	Projected Wholesale Allocation (MGD)					
Fiscal Year	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
1920-21	184.0	184.0	184.0	184.0	184.0	184.0
1921-22	184.0	184.0	184.0	184.0	184.0	184.0
1922-23	184.0	184.0	184.0	184.0	184.0	184.0
1923-24	184.0	184.0	184.0	184.0	184.0	184.0
1924-25	152.6	184.0	184.0	184.0	184.0	184.0
1925-26	184.0	184.0	184.0	184.0	184.0	184.0
1926-27	184.0	184.0	184.0	184.0	184.0	184.0
1927-28	184.0	184.0	184.0	184.0	184.0	184.0
1928-29	184.0	184.0	184.0	184.0	184.0	184.0
1929-30	184.0	184.0	184.0	184.0	184.0	184.0
1930-31	184.0	184.0	184.0	184.0	184.0	184.0
1931-32	129.2	152.6	152.6	152.6	152.6	152.6
1932-33	184.0	184.0	184.0	184.0	184.0	184.0
1933-34	184.0	184.0	184.0	184.0	184.0	184.0
1934-35	152.9	184.0	184.0	184.0	184.0	184.0
1935-36	184.0	184.0	184.0	184.0	184.0	184.0
1936-37	184.0	184.0	184.0	184.0	184.0	184.0
1937-38	184.0	184.0	184.0	184.0	184.0	184.0
1938-39	184.0	184.0	184.0	184.0	184.0	184.0
1939-40	184.0	184.0	184.0	184.0	184.0	184.0
1940-41	184.0	184.0	184.0	184.0	184.0	184.0
1941-42	184.0	184.0	184.0	184.0	184.0	184.0
1942-43	184.0	184.0	184.0	184.0	184.0	184.0
1943-44	184.0	184.0	184.0	184.0	184.0	184.0
1944-45	184.0	184.0	184.0	184.0	184.0	184.0
1945-46	184.0	184.0	184.0	184.0	184.0	184.0
1946-47	184.0	184.0	184.0	184.0	184.0	184.0
1947-48	184.0	184.0	184.0	184.0	184.0	184.0
1948-49	184.0	184.0	184.0	184.0	184.0	184.0
1949-50	184.0	184.0	184.0	184.0	184.0	184.0
1950-51	184.0	184.0	184.0	184.0	184.0	184.0
1951-52	184.0	184.0	184.0	184.0	184.0	184.0
1952-53	184.0	184.0	184.0	184.0	184.0	184.0
1953-54	184.0	184.0	184.0	184.0	184.0	184.0
1954-55	184.0	184.0	184.0	184.0	184.0	184.0
1955-56	184.0	184.0	184.0	184.0	184.0	184.0
1956-57	184.0	184.0	184.0	184.0	184.0	184.0
1957-58	184.0	184.0	184.0	184.0	184.0	184.0
1958-59	184.0	184.0	184.0	184.0	184.0	184.0
1959-60	184.0	184.0	184.0	184.0	184.0	184.0
1960-61	152.6	184.0	184.0	184.0	184.0	184.0

	Wholesale Demand (MGD)					
	184.0	184.0	184.0	184.0	184.0	184.0
	Projected Wholesale Allocation (MGD)					
Fiscal Year	2015	2020	2025	2030	2035	2040
1961-62	129.2	152.6	152.6	152.6	152.6	152.6
1962-63	184.0	184.0	184.0	184.0	184.0	184.0
1963-64	184.0	184.0	184.0	184.0	184.0	184.0
1964-65	184.0	184.0	184.0	184.0	184.0	184.0
1965-66	184.0	184.0	184.0	184.0	184.0	184.0
1966-67	184.0	184.0	184.0	184.0	184.0	184.0
1967-68	184.0	184.0	184.0	184.0	184.0	184.0
1968-69	184.0	184.0	184.0	184.0	184.0	184.0
1969-70	184.0	184.0	184.0	184.0	184.0	184.0
1970-71	184.0	184.0	184.0	184.0	184.0	184.0
1971-72	184.0	184.0	184.0	184.0	184.0	184.0
1972-73	184.0	184.0	184.0	184.0	184.0	184.0
1973-74	184.0	184.0	184.0	184.0	184.0	184.0
1974-75	184.0	184.0	184.0	184.0	184.0	184.0
1975-76	184.0	184.0	184.0	184.0	184.0	184.0
1976-77	152.6	184.0	184.0	184.0	184.0	184.0
1977-78	129.2	152.6	152.6	152.6	152.6	152.6
1978-79	184.0	184.0	184.0	184.0	184.0	184.0
1979-80	184.0	184.0	184.0	184.0	184.0	184.0
1980-81	184.0	184.0	184.0	184.0	184.0	184.0
1981-82	184.0	184.0	184.0	184.0	184.0	184.0
1982-83	184.0	184.0	184.0	184.0	184.0	184.0
1983-84	184.0	184.0	184.0	184.0	184.0	184.0
1984-85	184.0	184.0	184.0	184.0	184.0	184.0
1985-86	184.0	184.0	184.0	184.0	184.0	184.0
1986-87	184.0	184.0	184.0	184.0	184.0	184.0
1987-88	152.6	184.0	184.0	184.0	184.0	184.0
1988-89	129.2	152.6	152.6	152.6	152.6	152.6
1989-90	129.2	152.6	152.6	152.6	152.6	152.6
1990-91	129.2	132.5	132.5	132.5	132.5	132.5
1991-92	129.2	132.5	132.5	132.5	132.5	132.5
1992-93	129.2	132.5	132.5	132.5	132.5	132.5
1993-94	184.0	184.0	184.0	184.0	184.0	184.0
1994-95	184.0	184.0	184.0	184.0	184.0	184.0
1995-96	184.0	184.0	184.0	184.0	184.0	184.0
1996-97	184.0	184.0	184.0	184.0	184.0	184.0
1997-98	184.0	184.0	184.0	184.0	184.0	184.0
1998-99	184.0	184.0	184.0	184.0	184.0	184.0
1999-00	184.0	184.0	184.0	184.0	184.0	184.0
2000-01	184.0	184.0	184.0	184.0	184.0	184.0
2001-02	184.0	184.0	184.0	184.0	184.0	184.0
2002-03	184.0	184.0	184.0	184.0	184.0	184.0
2003-04	184.0	184.0	184.0	184.0	184.0	184.0

Fiscal Year	Wholesale Demand (MGD)					
	184.0	184.0	184.0	184.0	184.0	184.0
	Projected Wholesale Allocation (MGD)					
	2015	**2020**	**2025**	**2030**	**2035**	**2040**
2004-05	184.0	184.0	184.0	184.0	184.0	184.0
2005-06	184.0	184.0	184.0	184.0	184.0	184.0
2006-07	184.0	184.0	184.0	184.0	184.0	184.0
2007-08	184.0	184.0	184.0	184.0	184.0	184.0
2008-09	184.0	184.0	184.0	184.0	184.0	184.0
2009-10	184.0	184.0	184.0	184.0	184.0	184.0
2010-11	184.0	184.0	184.0	184.0	184.0	184.0

MGD = million gallons per day

APPENDIX D

SB X7-7 Verification Form

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission
April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

SB X7-7 Table 0: Units of Measure Used in UWMP* *(select one from the drop down list)*
Acre Feet
**The unit of measure must be consistent with Table 2-3*
NOTES: The units of measure used in the body of the UWMP are millions of gallons per day (mgd).

SB X7-7 Table-1: Baseline Period Ranges			
Baseline	**Parameter**	**Value**	**Units**
10- to 15-year baseline period	2008 total water deliveries	85,900	Acre Feet
	2008 total volume of delivered recycled water	0	Acre Feet
	2008 recycled water as a percent of total deliveries	0.00%	Percent
	Number of years in baseline period[1]	10	Years
	Year beginning baseline period range	2001	
	Year ending baseline period range[2]	2010	
5-year baseline period	Number of years in baseline period	5	Years
	Year beginning baseline period range	2006	
	Year ending baseline period range[3]	2010	

[1] *If the 2008 recycled water percent is less than 10 percent, then the first baseline period is a continuous 10-year period. If the amount of recycled water delivered in 2008 is 10 percent or greater, the first baseline period is a continuous 10- to 15-year period.*

[2] *The ending year must be between December 31, 2004 and December 31, 2010.*

[3] *The ending year must be between December 31, 2007 and December 31, 2010.*

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

SB X7-7 Table 3: Service Area Population		
Year		**Population**
10 to 15 Year Baseline Population		
Year 1	2001	782,248
Year 2	2002	784,398
Year 3	2003	784,229
Year 4	2004	782,934
Year 5	2005	781,806
Year 6	2006	782,906
Year 7	2007	788,913
Year 8	2008	796,775
Year 9	2009	801,990
Year 10	2010	806,982
5 Year Baseline Population		
Year 1	2006	782,906
Year 2	2007	788,913
Year 3	2008	796,775
Year 4	2009	801,990
Year 5	2010	806,982
2015 Compliance Year Population		
2015		847,370

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

SB X7-7 Table 2: Method for Population Estimates	
Method Used to Determine Population (may check more than one)	
☑	**1. Department of Finance (DOF)** DOF Table E-8 (1990 - 2000 and 2000-2010) and DOF Table E-5 (2011 - 2015) when available
☑	**2. Persons-per-Connection Method**
☑	**3. DWR Population Tool**
☑	**4. Other** DWR recommends pre-review

NOTES:

(a) County of San Francisco population for 2001-2010 was obtained from DOF Table E-8. Population data for 2001 through 2009 are for January 1 of the applicable year, whereas population data for 2010 is for April 1, 2010 per the revised 2010 decennial census count.

(b) County of San Francisco population for 2015 was obtained from DOF Table E-5.

(c) Populations of suburban retail customers located in Redwood City, Daly City, Fremont, Millbrae, and Castlewood were estimated based on persons-per-connection method using data from the 2000 and 2010 U.S. Census at the census block level.

(d) Inmate population of the San Francisco County Jail #5 in San Bruno was provided by staff of the San Francisco Sheriff's Department.

(e) Population of retail customers in the Town of Sunol was estimated using the DWR Population Tool.

(f) Other suburban retail customers include individual research and commercial facilities, such as the Lawrence Livermore National Laboratory, San Francisco International Airport, National Aeronautics and Space Administration, etc. Because these are non-residential facilities, their population is assumed to be zero.

(g) Methodology applicable to the suburban retail service area was discussed with DWR (pre-review).

SB X7-7 Table 4: Annual Gross Water Use *

	Baseline Year *Fm SB X7-7 Table 3*	**Volume Into Distribution System** *Fm SB X7-7 Table(s) 4-A*	Deductions					**Annual Gross Water Use**
			Exported Water	Change in Dist. System Storage (+/-)	Indirect Recycled Water *Fm SB X7-7 Table 4-B*	Water Delivered for Agricultural Use	Process Water *Fm SB X7-7 Table(s) 4-D*	
10 to 15 Year Baseline - Gross Water Use								
Year 1	2001	101,000	0	-8	0	0	0	101,008
Year 2	2002	101,230	0	-1	0	0	0	101,231
Year 3	2003	97,710	0	173	0	0	0	97,537
Year 4	2004	94,990	0	27	0	0	0	94,963
Year 5	2005	94,940	0	-100	0	0	0	95,040
Year 6	2006	93,640	0	-5	0	0	0	93,645
Year 7	2007	91,510	0	31	0	0	0	91,479
Year 8	2008	91,280	0	5	0	0	0	91,275
Year 9	2009	88,720	0	-16	0	0	0	88,736
Year 10	2010	85,120	0	71	0	0	0	85,049
10 - 15 year baseline average gross water use								**93,996**
5 Year Baseline - Gross Water Use								
Year 1	2006	93,640	0	-5	0	0	0	93,645
Year 2	2007	91,510	0	31	0	0	0	91,479
Year 3	2008	91,280	0	5	0	0	0	91,275
Year 4	2009	88,720	0	-16	0	0	0	88,736
Year 5	2010	85,120	0	71	0	0	0	85,049
5 year baseline average gross water use								**90,037**
2015 Compliance Year - Gross Water Use								
2015		77,910	0	0	0	0	0	**77,910**

* NOTE that the units of measure must remain consistent throughout the UWMP, as reported in Table 2-3

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

SB X7-7 Table 4-A: Volume Entering the Distribution System(s)

Complete one table for each source.

Name of Source: RWS

This water source is:

- [x] The supplier's own water source
- [ ] A purchased or imported source

Baseline Year Fm SB X7-7 Table 3		Volume Entering Distribution System	Meter Error Adjustment* Optional (+/-)	Corrected Volume Entering Distribution System
10 to 15 Year Baseline - Water into Distribution System				
Year 1	2001	98,550	0	98,550
Year 2	2002	98,780	0	98,780
Year 3	2003	95,260	0	95,260
Year 4	2004	92,540	0	92,540
Year 5	2005	92,490	0	92,490
Year 6	2006	91,190	0	91,190
Year 7	2007	89,060	0	89,060
Year 8	2008	88,830	0	88,830
Year 9	2009	86,270	0	86,270
Year 10	2010	82,670	0	82,670
5 Year Baseline - Water into Distribution System				
Year 1	2006	91,190	0	91,190
Year 2	2007	89,060	0	89,060
Year 3	2008	88,830	0	88,830
Year 4	2009	86,270	0	86,270
Year 5	2010	82,670	0	82,670
2015 Compliance Year - Water into Distribution System				
2015		75,460	0	75,460

** Meter Error Adjustment - See guidonce in Methodology 1, Step 3 of Methodologies Document*

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

SB X7-7 Table 4-A: Volume Entering the Distribution System(s)

Complete one table for each source.

Name of Source: Groundwater

This water source is:

- [x] The supplier's own water source
- [ ] A purchased or imported source

Baseline Year Fm SB X7-7 Table 3		Volume Entering Distribution System	Meter Error Adjustment* Optional (+/-)	Corrected Volume Entering Distribution System
10 to 15 Year Baseline - Water into Distribution System				
Year 1	2001	2,450		2,450
Year 2	2002	2,450		2,450
Year 3	2003	2,450		2,450
Year 4	2004	2,450		2,450
Year 5	2005	2,450		2,450
Year 6	2006	2,450		2,450
Year 7	2007	2,450		2,450
Year 8	2008	2,450		2,450
Year 9	2009	2,450		2,450
Year 10	2010	2,450		2,450
5 Year Baseline - Water into Distribution System				
Year 1	2006	2,450		2,450
Year 2	2007	2,450		2,450
Year 3	2008	2,450		2,450
Year 4	2009	2,450		2,450
Year 5	2010	2,450		2,450
2015 Compliance Year - Water into Distribution System				
2015		2,450		2,450

** Meter Error Adjustment - See guidonce in Methodology 1, Step 3 of Methodologies Document*

NOTES: Groundwater use has found to be constant throughout the years, which consists of 1.5 mgd (1,680 AF) of in-city irrigation use, 0.4 mgd (450 AF) for Castlewood CSA, and another 0.3 mgd (340 AF) for the Sunol Valley Golf Course.

SB X7-7 Table 5: Gallons Per Capita Per Day (GPCD)				
Baseline Year *Fm SB X7-7 Table 3*		Service Area Population *Fm SB X7-7 Table 3*	Annual Gross Water Use *Fm SB X7-7 Table 4*	Daily Per Capita Water Use (GPCD)
10 to 15 Year Baseline GPCD				
Year 1	2001	782,248	101,008	115
Year 2	2002	784,398	101,231	115
Year 3	2003	784,229	97,537	111
Year 4	2004	782,934	94,963	108
Year 5	2005	781,806	95,040	109
Year 6	2006	782,906	93,645	107
Year 7	2007	788,913	91,479	104
Year 8	2008	796,775	91,275	102
Year 9	2009	801,990	88,736	99
Year 10	2010	806,982	85,049	94
10-15 Year Average Baseline GPCD				**106**
5 Year Baseline GPCD				
Baseline Year *Fm SB X7-7 Table 3*		Service Area Population *Fm SB X7-7 Table 3*	Gross Water Use *Fm SB X7-7 Table 4*	Daily Per Capita Water Use
Year 1	2006	782,906	93,645	107
Year 2	2007	788,913	91,479	104
Year 3	2008	796,775	91,275	102
Year 4	2009	801,990	88,736	99
Year 5	2010	806,982	85,049	94
5 Year Average Baseline GPCD				**101**
2015 Compliance Year GPCD				
2015		847,370	77,910	82

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

SB X7-7 Table 6: Gallons per Capita per Day *Summary From Table SB X7-7 Table 5*	
10-15 Year Baseline GPCD	106
5 Year Baseline GPCD	101
2015 Compliance Year GPCD	82
NOTES:	

SB X7-7 Table 7: 2020 Target Method *Select Only One*		
Target Method		Supporting Documentation
☐	Method 1	SB X7-7 Table 7A
☐	Method 2	SB X7-7 Tables 7B, 7C, and 7D *Contact DWR for these tables*
☑	Method 3	SB X7-7 Table 7-E
☐	Method 4	Method 4 Calculator
NOTES:		

SB X7-7 Table 7-E: Target Method 3				
Agency May Select More Than One as Applicable	Percentage of Service Area in This Hydrological Region	Hydrologic Region	"2020 Plan" Regional Targets	Method 3 Regional Targets (95%)
☐		North Coast	137	130
☐		North Lahontan	173	164
☐		Sacramento River	176	167
☑	100%	San Francisco Bay	131	124
☐		San Joaquin River	174	165
☐		Central Coast	123	117
☐		Tulare Lake	188	179
☐		South Lahontan	170	162
☐		South Coast	149	142
☐		Colorado River	211	200
Target *(If more than one region is selected, this value is calculated.)*				**124**

NOTES:
Per DWR direction, Groveland CSD is accounted for as a wholesale customer and is therefore excluded from SB X7-7 calculations.

SB X7-7 Table 7-F: Confirm Minimum Reduction for 2020 Target			
5 Year Baseline GPCD *From SB X7-7 Table 5*	Maximum 2020 Target*	Calculated 2020 Target *Fm Appropriate Target Table*	Confirmed 2020 Target
101	96		96
** Maximum 2020 Target is 95% of the 5 Year Baseline GPCD*			
NOTES:			

SB X7-7 Table 8: 2015 Interim Target GPCD		
Confirmed 2020 Target *Fm SB X7-7 Table 7-F*	10-15 year Baseline GPCD *Fm SB X7-7 Table 5*	2015 Interim Target GPCD
96	106	101
NOTES:		

SB X7-7 Table 9: 2015 Compliance

Actual 2015 GPCD	2015 Interim Target GPCD	Optional Adjustments *(in GPCD)*					2015 GPCD *(Adjusted if applicable)*	Did Supplier Achieve Targeted Reduction for 2015?
		Extraordinary Events	Weather Normalization	Economic Adjustment	TOTAL Adjustments	Adjusted 2015 GPCD		
82	101	*From Methodology 8 (Optional)*	*From Methodology 8 (Optional)*	*From Methodology 8 (Optional)*	0	82	82	YES
NOTES:								

This page intentionally left blank.

APPENDIX E

2015 Retail Demand Model and Projections Technical Memorandum

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

Technical Memorandum:

SFPUC Retail Demand Model and Projections through Fiscal Year 2039-40

PREPARED FOR

San Francisco Public Utilities Commission

PREPARED BY

Steven Buck, Ph.D.
David Sunding, Ph.D.

December 21, 2015

THE Brattle GROUP

This report was prepared for the San Francisco Public Utilities Commission. All results and any errors are the responsibility of the authors and do not represent the opinion of The Brattle Group, Inc. or its clients.

Acknowledgement: We acknowledge the valuable contributions of many individuals to this report and to the underlying analysis.

Table of Contents

1 SUMMARY

The models described in this Technical Memo develop the water demand projections for the San Francisco Public Utilities Commission (SFPUC) in-City retail service area[1], herein referred as the City and County of San Francisco (CCSF). These models consist of two parts, which we summarize.

First, we make assumptions about CCSF specific growth in demand drivers and demand factors. Demand *drivers* reference the number of users in each sector; specifically, we make assumptions about the percentage growth in the number of single family residential households, multi-family households and employees. Demand *factors* reference a host of factors that affect consumer consumption per user in each of the single family residential (SFR), multi-family residential (MFR) and commercial and industrial (CI) sectors. In this analysis the demand factors of interest for the SFR sector are water price and household income; the demand factor of interest for the MFR and CI sectors is price. CCSF-specific growth projections for the demand drivers (i.e., the number of water users in each sector) and demand factors (i.e., water price and household income) are based on planning projections for CCSF through the year 2040.

Second, we make assumptions regarding how users change consumption in response to CCSF-specific projected changes in the demand factors of water price and household income. These user-level consumption responses to changes in price and income are referenced as price elasticities and income elasticities, respectively. The price elasticity tells us how much consumption per user changes in response to a percentage change in price; the income elasticity tells us how much consumption per user changes in response to a percentage change in household income. These response parameters are very useful for the purpose of projecting

---

1 The SFPUC's retail service area is nearly contiguous with the CCSF jurisdictional boundary except for a small portion of suburban retail customers outside of CCSF, including the Town of Sunol, Castlewood Country Club, Groveland Community Services District, Lawrence Livermore National Laboratory, and portions of the Redwood City and Daly City. Suburban retail demands are projected separately and are not the subject of this document.

changes over time in consumption per user. Using standard methods from economics and data on real water users in CCSF and the surrounding San Francisco Bay Area we estimate these response parameters. Their estimation requires we develop separate statistical models of consumption per user for the SFR, MFR and CI sectors; these are the sectorial regression models. The results of the regression analyses are robust and statistically significant at the conventional level used for hypothesis testing.[2] The results are also generally consistent with other, similar studies in the academic literature.[3] An advantage of using regression models to estimate consumption per user is that the price and income elasticities can be identified based on historic variations in relevant variables, and on the actual behavior of users, while taking into account differences in other demand factors (e.g., lot size or average temperature) between CCSF users and other users in the Bay Area. More detailed justification and description of the assumptions entailed in using data from non-CCSF utilities to develop the regression models are described in subsequent sections.

The estimated price and income elasticities, which tell us how much user-level consumption changes in response to a percentage changes in price and income, are used to (i) adjust average consumption per user in the baseline period to account for atypical demand conditions in the fiscal year (FY) 2009-10 and (ii) project how average consumption per user will change in future periods from the baseline period. The baseline period used in this analysis is the fiscal year FY2009-10 which, once again, is adjusted for atypical conditions. Projections of future demand are prepared in five year increments for FY2014-15 through FY2039-40. Table 1 below summarizes the demand projections in millions gallons per day (mgd) for CCSF and reflects growth in the demand drivers (i.e., the number of water users in each sector) and growth in consumption per user in each sector due to projected changes in the demand factors of price and income.

---

2 The significance level indicates the probability of falsely detecting a statistically significant effect.

3 Espey, M., J. Espey, and W. D. Shaw. 1997. Price Elasticity of Residential Demand for Water: A Meta-Analysis. *Water Resources Research* 33: 1367–1374.

Table 1. Summary of Demand Projections by Sector (million gallons per day)

	FY2014-5	FY2019-20	FY2024-25	FY2029-30	FY2034-35	FY2039-40
Single Family Residential	15.85	15.71	16.54	17.95	19.50	21.08
Multi-Family Residential	20.46	20.32	20.95	22.05	23.15	24.29
Commercial and Industrial	21.88	22.55	22.55	23.02	23.90	24.98

The remainder of this technical memo is organized as follows. Sections 2 summarizes the general data requirements for development of the regression models that quantify the relationship between consumption and demand factors, justifies the use of data from CCSF and non-CCSF utilities to develop the regression models, and describes the assumptions entailed in using non-CCSF data for model development. Sections 3, 4 and 5 present the sectorial regression models that are used for (i) adjusting the base period consumption to serve as a launch point from which future demand is projected to grow and (ii) projecting growth in demand due to changing demand factors. Sections 6 and 7 summarize the method, data and calculation of the adjusted baseline demands and the demand forecasts going in to the future, respectively.

2 Data Requirements for development of statistical models that quantify the relationship between consumption patterns and demand factors

In order to predict how water demand in CCSF will change over time, it is necessary to assess the relationship between water use and the demand factors used in this analysis (price and income). Generally, water use and water price are negatively correlated. In other words, as water becomes more expensive, users will reduce their demands to offset the higher costs. Oppositely, water use and household income are usually positively correlated, suggesting that water use increases as income increases. These relationships exist simultaneously and are integral to understanding water use and assessing how water demand will change over time; further, these relationships may depend on each other. For example, consider households A and B. Household A has an annual income of $100,000 per year, while household B takes in $50,000 each year. If the price of water doubles, both households are likely to curtail water demand (each house will cut back to

the point where the value of the additional unit of water equals the cost of that unit). However, household B may be more sensitive to water prices than household A since the cost of water represents a larger share of household expenses. The relationship between water price and water demand is known as the price elasticity of demand and is calculated as the percent change in water demand for a given percent change in water price. For example, a price elasticity of -0.2 implies that users reduce water demand by 0.2% for each 1% increase in price. Similarly, income elasticity is defined as a percent change in water demand given a percent change in household income.

Quantifying the relationship between water price and the demand factors can be accomplished using a statistical technique called regression analysis. Generally, regression analysis is used to explain how observed changes in one or more explanatory variables (e.g., water price) impact a response variable (e.g., water consumption). Developing regression models requires the collection of data that varies over space, time, or both. If sufficient variation in the observed data does not exist, regression analysis will be incapable of accurately assessing how the response variable is impacted by the demand factor. Since water prices within a utility do not change frequently, this analysis makes use of water consumption and water price data from multiple California retailers between 1996 and 2009.[4] By controlling for differences across water utilities and variation due to other factors (such as lot size and weather patterns), this analysis isolates the impact that water price and household income have on water demand.

To be clear, the regression models used in this technical memo allow the analyst to forecast future changes in consumption *per user* in response to future changes in demand factors (e.g., price and income). The regression models do not model aggregate consumption growth in each sector; that is, they do not take into account forecasted growth in the number of households or

---

4 There are some utilities which are notable exceptions and, in fact, CCSF does have historical variation in prices. The analysis is able to take advantage of the year-to-year changes in CCSF prices as an additional source of variation, and this is discussed in subsequent sections.

employment—growth in these demand drivers is addressed in a separate step described later in the main text of this Technical Memo.

Further Discussion: Why does the development of the regression models require historical data on non-CCSF utilities?

The regression model for the SFR sector estimates parameters for (i) the rate of change in household consumption in response to changes in price and for (ii) the rate of change of household consumption in response to changes in household income. The estimation of the price and income elasticities (consumption response parameters) in the SFR sector requires historical data on these factors from both the CCSF service area but also other Bay Area service areas. Data from non-CCSF utilities is required in order to estimate these elasticities because without it there would be no variation in price or income to recover an estimate since CCSF represents only one data point. An analyst can only make an inference about the effect of price on consumption if the analyst observes consumers facing different prices. The average change in household consumption per percentage change in price cannot be calculated without observing differences in consumption corresponding to differences in price. At least two data points per year are required in order to net out the idiosyncratic effects on consumption due to demand conditions of a particular year. Further, more than two data points by year will enhance the statistical accuracy and precision of the estimated price and income elasticities. For these reasons, the regression model development benefits from inclusion of historical data from non-CCSF utilities. To be sure, no assumptions are made that CCSF is identical to non-CCSF utilities in terms of demand drivers or demand factors.

While data from non-CCSF utilities are utilized in the estimation of the regression model, no assumption is made that CCSF users face similar demand conditions in terms of price, weather or have similar demand factors in terms of household income, lot size or the average number of household members. Nor is it assumed that CCSF users will face identical growth patterns in price, household income or other factors.

A key assumption of the analysis for the SFR sector is that, after accounting for other demand factors (e.g., lot size and average temperature), areas forecasted to experience similar percentage

changes in household income are predicted to experience similar percentage changes in consumption. It is only in this regard that users in CCSF and non-CCSF areas are assumed to be identical, and the assumption is only made after accounting for differences in other demand factors.

In the case of price, this assumption of uniform consumption response across CCSF and non-CCSF areas is relaxed. Year-to-year changes in price faced by SFR users in CCSF is used as an additional source of variation to identify how users change consumption in response to a price change. Therefore, unlike the income response, we are estimating a CCSF specific consumer response to a change in price that is distinct from the responses of customers in the non-CCSF service areas; CCSF consumers in the SFR sector tend to be somewhat less responsive to price changes relative to other areas of California.

The regression models for the MFR sector and CI sector estimate price elasticities (the sector-specific parameters for the rate of change in consumption in response to changes in price). For the same reasons as discussed for the analysis of the SFR sector, the estimation of the price elasticities in the MFR and CI sectors requires historical data from both CCSF and non-CCSF utilities. Once again, this is not an assumption that CCSF users in the MFR or CI sectors face similar demand conditions or have similar demand factors; nor is it assumed that CCSF users in the MFR or CI sectors will face identical growth patterns in demand factors as experienced in non-CCSF service areas. The key assumption of the analysis for these two sectors is that, after accounting for differences in other demand factors, areas forecasted to experience similar percentage changes in price are predicted to experience similar percentage changes in consumption.

Finally, income elasticities are not estimated for the MFR and CI sectors. No statistically significant relationship is found between income and consumption in the MFR sector, and there is no clear theoretical justification to include income in the regression model for the CI sector.

3 Single Family Residential Demand Regression Model

The regression model of SFR household demand is developed based on historical price and water consumption from CCSF and other utilities in the San Francisco Bay Area. SFPUC provided accounts and consumption data for the CCSF service area, while data for non-CCSF utilities were obtained from Bay Area Water Supply & Conservation Agency (BAWSCA) Annual Surveys (FY1996-96 through FY2010-11)[5]. Monthly household consumption is calculated in terms of hundred cubic feet (ccf) by dividing annual consumption at the utility level by the number of SFR accounts, and then dividing the resulting quantity by 12 months.

The price of water is an important factor determining the amount of water demanded by SFR users, and the responsiveness of water consumption to price is a major component of developing projections of future demand. Utility level historical data on rates faced by residential consumers of non-CCSF utilities are obtained from the BAWSCA Annual Surveys. SFPUC provided rate data for the CCSF service area. The marginal price of water is measured using the median tier on a utility's rate schedule. Prices are adjusted for inflation so consumer response to real[6] price changes is measured.

In addition to the price factor, SFR consumption per household is modeled as function of household income, the age of the housing stock, household size, residential density (i.e., the inverse of lot size), precipitation and temperature. For all variables the most recent data available that covers all of the service areas at a spatial layer at or beneath utility-specific boundaries is

---

5 SFPUC's Wholesale Customers were used for the regression analysis as opposed to other Bay Area utilities due to their proximity to CCSF and accessibility of data available. Historical data on annual SFR consumption and SFR metered accounts are taken from the BAWSCA Annual Surveys.

6 When comparing prices across years it is important to account for inflation. For example, suppose the price of a unit of water is \$1.00 USD on January 1st in the year 2000 and \$1.03 USD on January 1st in the year 2001. If there was 3% inflation between these dates, then real price of water has not changed. Consistent with this, we say that the real price of a unit of water on January 1st, 2001 in terms of year 2000 USD is \$1.00. In summary, in order to compare the price of a good across years without the effect of inflation, it is common to convert prices across all years to a common base year's real price. In the current analysis we convert all prices to year 2000 real USD.

used. In this way, utility-specific average consumption per user is related to measures of utility-specific demand factors.

Household income, household size and housing vintage variables are based on Census tract level data. The average utility level values of these variables were calculated by intersecting Census tract boundaries with utility-specific boundaries using ArcView and then taking an area- and housing-density-weighted average of the Census tracts that comprise each utility's service area. The average value of the lot size variable within a utility is based on ZIP-code level data that is used to construct an area- and housing-density weighted average of lot size.

The weather variables used in developing the regression model are average maximum daily temperature during the summer months of July, August, and September; and total annual precipitation. These variables are ZIP-code based[7], and were used to construct area- and housing-density weighted averages of the precipitation and temperature variables for each specific utility.

In addition to accounting for the above demand factors, the regression model of SFR household demand accounts for unobserved differences in demand factors across counties (e.g., average adoption of best management practices) so that the price and income elasticities are estimated taking into account CCSF-specific unobserved demand characteristics. Fixed effects are considered at a county level, instead of at a utility level, because this generated more precise estimates in the regression model without sacrificing accuracy. Also, using county fixed effects instead of utility fixed effects permitted estimation of the income elasticity, which is not considered in the other sectorial models. The SFR regression model also allows for the relationship between average household consumption and price to depend on household income and location by interacting the price variable with household income, and interacting the price

---

7 PRISM Climate Group, "Near-Real-Time High-Resolution Monthly Average Maximum/Minimum Temperature for the Conterminous United States", raster digital data, accessible: http://www.prism.oregonstate.edu/.

variable with county indicator variables. Therefore, we are able to model a CCSF-specific price elasticity based on CCSF-specific household income measure and location. Household consumption and all demand factors are transformed into logarithmic form for the regression analysis. The natural logarithmic transformation simplifies the interpretation of the regression results, which report a coefficient for each demand factor. The benefit of logarithmic form is that each coefficient can be interpreted as an elasticity. An elasticity measure represents the percentage change in household water consumption resulting from a one percent change in a particular demand factor.

In summary, the estimating equation for the SFR demand regression model is described by the following equation:

$$\ln(q_{ijt}) = \beta_0 + \beta_1 * p_{it} + \beta_2 * p_{it} * inc_i + \sum_{j=2}^{4} \gamma_j * p_{it} * I_{cnty} + \beta_3 * X_{it} + \mu_j + \varepsilon_{ijt} \quad \text{(eq. 1)}$$

where i is the utility, j is the county, and t is the year; q_{it} is average monthly household consumption; p_{it} is median tier price; inc_i is the median household income; I_{cnty} is an indicator variable denoting whether or not an observation belongs to county *j*; X_{it} represents the covariates of median household income, median lot size, average household size, median housing age, annual precipitation, and average summer maximum daily temperature[8]; μ_j is a county fixed effect[9]; and ε_{ijt} represents all unobservable factors affecting consumption. The results of the regression estimation in terms of the relevant elasticities for use in sections 6 and 7 are presented Table 2. Data sources are summarized in Appendix B.

---

8 Annual precipitation and average daily summer maximum temperature varies across utilities and years; the other covariates are time invariant and only vary across utilities.

9 A county fixed effect is a county specific intercept and models unobserved demand factors varying by county. Said differently, a dummy variable representing each county is included in the regression equation. Therefore, the SFR regression model takes into account unobserved demand factors specific to CCSF.

Table 2. Results of the Single Family Residential Demand Regression

Demand factor	Elasticity (the average demand response to a 1% increase in the demand factor)	Example: % change in water consumption in response to a 10% increase in the demand factor
Retail price	-0.24	-2.4%
Median household income	1.02	10.2%
Annual precipitation	-0.09	-0.9%
Average daily summer maximum temperature	0.11	1.1%

4 Multi-Family Residential Demand Regression Model

A model of MFR aggregate demand is developed based on historical water consumption in CCSF and non-CCSF service areas. Demand is not modeled at the household level because there is no data source available which tracks the number of MFR households in each service area on an annual basis. Similar to the SFR sector, aggregate consumption is recorded by fiscal year at the utility level. SFPUC billing is the source of historical consumption data for the CCSF service area, and the BAWSCA Annual Surveys are the source for non-CCSF service areas.

The MFR price variable is identical to that used in the SFR demand model and reports the price of water for each utility. Consumption and price are transformed into logarithmic form for the regression analysis. Once again, this transformation of the data simplifies the interpretation of the regression analysis, which reports a coefficient (i.e., an elasticity) that defines the percentage change in utility-level water consumption in the MFR sector resulting from a one percent change in price. The MFR regression model indicates a price elasticity of demand of -0.17, which is less elastic than that estimated for the SFR sector (-0.24). This result is intuitive in that MFR housing units have relatively little outdoor water-use and utilize a variety of shared appliances. As a consequence, MFR users are more likely to be directing their current water consumption towards higher priority uses than users in the SFR sector because they have less discretionary water use such as landscaping. In addition, if occupants of MFR housing units are likely to have

lower incomes than SFR customers, then they may have fewer water-using appliances and, therefore, less discretionary water use.

In summary, the estimating equation for the MFR demand regression model is described by the following equation:

$$\ln(Q_{it}) = \beta_0 + \beta_1 * p_{it} + \mu_i + \varepsilon_{it} \qquad \text{(eq. 2)}$$

where i is the utility and t is the year; Q_{it} is aggregate household consumption; p_{it} is median tier price; μ_i is a utility fixed effect[10]; and ε_{it} represents all unobservable factors affecting consumption.[11] The results of the regression estimation in terms of the relevant elasticities for use in sections 6 and 7 are presented Table 3. Data sources are summarized in Appendix B.

Table 3. Results of the Multi-Family Residential Demand Regression

Demand factor	Elasticity (the average demand response to a 1% increase in the demand factor)	Example: % change in water consumption in response to a 10% increase in the demand factor
Retail price	-0.17	-1.7%

10 A utility fixed effect is a utility specific intercept that accounts for differences between utilities in unobserved demand factors. From a statistical standpoint, an indicator variable representing each service area is included in the regression equation.

11 Using a county fixed effect for the non-SFR models would enhance precision but sacrifice the accuracy of the estimates. Therefore, in these other sectorial models we use utility fixed effects which account for more unobserved factors than models with county fixed effects.

5 Commercial and Industrial Demand Regression Model

The third water demand regression model is for CI water use. Consistent with much of the academic literature on water demand, the econometric model of CI water demand analyzes water-use per employee. This measure is developed based on historical CI water consumption in CCSF and non-CCSF service areas. Notably, institutional, governmental and municipal sector consumption is not included with CI demand because their inclusion makes the statistical model less precise and tractable. This may be due to significant heterogeneity in consumption (e.g., type of water use, outdoor versus indoor use) and/or supply sources (e.g., these accounts may be serviced by alternative water supplies such as recycled water which often faces a different price). Similar to the residential sectors, aggregate CI consumption is recorded by fiscal year at the utility level.

Employment data needed to calculate water-use per employee is taken from the Quarterly Census of Employment and Wages, which is a census of all establishments that pay payroll taxes. The California Employment Development Department (EDD) has complete access to the establishment level (employer by location) raw data from the year 2005 to present. Electronic files of the CCSF and non-CCSF retail service area boundaries were submitted to EDD; and their GIS specialists aggregated the establishment level employment counts to the level of each utility's service area based on the service area boundaries.

The CI water-use per employee is modeled based on price and utility level measures of precipitation, temperature, and cooling degree-days. The model also accounts for different levels of base consumption across agencies through the inclusion of utility fixed effects, which account for baseline differences in unobserved demand factors. The price and weather variables in the CI model are identical to those used in the residential sectors.

Consumption and all demand factors are transformed into logarithmic form for the regression analysis. Once again, this transformation simplifies the interpretation of the regression analysis, which reports a coefficient (i.e., an elasticity) for each demand factor. The elasticity defines the

percentage change in CI water consumption resulting from a one percent change in a particular demand factor.

All else being equal, individual water agencies with higher prices have lower water-use per employee. CI customers located in areas with more precipitation consume less water while those areas with warmer temperatures consume more. The regression accounts for cooling degree-days, which has a negligible estimated effect on water-use per employee.

In summary, the estimating equation for the CI demand regression model is described by the following equation:

$$\ln(q_{it}) = \beta_0 + \beta_1 * p_{it} + \beta_3 * X_{it} + \mu_i + \varepsilon_{it} \qquad \text{(eq. 3)}$$

where i is the utility and t is the year; q_{it} is water-use per employee; p_{it} is median tier price; X_{it} represents the weather covariates of annual precipitation, average summer maximum daily temperature, and cooling degree days; μ_i is a utility fixed effect; and ε_{it} represents all unobservable factors affecting consumption. Table 4 presents the results of the CI regression analysis in terms of elasticities. Data sources are summarized in Appendix B.

Table 4: Summary of CI Estimation Results

Demand factor	Elasticity (the average demand response to a 1% increase in the demand factor)	Example: % change in water consumption in response to a 10% increase in the demand factor
Retail price	-0.15	-1.5%
Annual precipitation	-0.04	-0.4%
Average daily summer maximum temperature	0.48	4.8%

6 ADJUSTING BASELINE CONSUMPTION IN FY2010-11

This section summarizes the method of adjusting the baseline consumption period in FY2010-11 to account for atypical demand conditions.

A natural measure of baseline demand is consumption in the most recent year for which there is comprehensive consumption data, FY2010-11. The drawback to utilizing actual FY2010-11 demand as baseline consumption, in fact any specific year, is that there are idiosyncracies that make any given year different than an average year. This is especially true for FY2010-11 which was an unusual year in terms of weather and economic conditions. Temperatures were lower, total precipitation was higher, and the Bay Area economy was still lagging from the effects of the housing crisis and global recession. Together, these factors depressed water demand in the Bay Area, with the result that utilities recorded low levels of water sales. CCSF aggregate demand was down 11.8% in FY2010-11 relative to the three-year average between FY2005-06 to FY2007-08. Some of this reduction is likely due to increased conservation so the next step is to determine what portion of the reduction is due to conservation (which may be permanent) versus the portion due to atypical economic and weather conditions.

To account for the anomalous demand conditions of FY2010-11, it is necessary to determine what water demand would have been under 'normal' economic and weather conditions. This normalized level of demand is then taken as the basis for projecting future demands. The method for estimating normalized FY2010-11 demand takes actual demand in this year and adjusts for the effect of abnormal economic and weather conditions on the SFR and CI demands[12]. The resulting incremental amount of demand is calculated using the estimated demand factor elasticities from the sectorial regression models described in Section 3, 4 and 5.

---

[12] Normalization of MFR demands was considered, although they were found to be identical to actual MFR. Thus, we assume actual MFR demands to be unaffected by the abnormal conditions.

The FY2010-11 SFR demand adjustment takes into account precipitation, temperature and household income under normal conditions. Normal weather is taken to be the 30-year historical average (1980-2010) for a given utility's retail service area and is acquired from the PRISM Climate Group[13]. Normal income is measured as the average median household income in the three years immediately preceding the global recession (2005 – 2007). Annual data for median household income is obtained from the American Community Survey maintained by the Census Bureau and are measured at the county level.

Examination of the data for FY2010-11 confirms that this year was anomalous. For CCSF, average daily summer maximum temperature was down approximately 1% and annual precipitation was up close to 7%. Household income was 0.5% lower than in the three years preceding the housing crisis and resulting economic downturn. Adjusting for these unusual weather and economic conditions, estimated SFR demand in CCSF would have been approximately 0.21 mgd higher under 'normal' conditions than actual conditions in FY2010-11. We observe no significant difference when comparing the normalized and actual demands in the MFR sector. Thus, the normalized MFR demand is modeled as actual demand. In the CI sector we estimate demand for CCSF would have been approximately 0.5 mgd higher under 'normal' weather conditions

6.1 Detailed Description of Calculation for SFR Baseline Demand Adjustment

The SFR baseline demand adjustment is completed in the following way. First, aggregate annual demand in the SFR sector is divided by the total number of SFR accounts and divided by 12 months to arrive at the average monthly consumption per household (under the assumption that SFR account is equivalent to an SFR Household). This is the actual level of average monthly

---

[13] PRISM Climate Group, "Near-Real-Time Monthly High-Resolution Precipitation Climate Data Set for the Conterminous United States", raster digital data, accessible: http://www.prism.oregonstate.edu/.

household demand that occurred under unusual economic and weather conditions, which is referenced as q^{SFR}_{actual}.

Second, the incremental percentage increase in demand that would have occurred under normal economic and weather conditions is calculated. To calculate this incremental percentage increase in demand, the factor elasticities for income (ε_{inc}), average summer maximum daily temperature (ε_{temp}) and precipitation (ε_{rain}), are required. These factor elasticities are based on the SFR demand regression results.

The factor elasticities are multiplied by the difference in the corresponding factor (in logarithmic form) under actual FY2010-11 conditions compared to normal conditions. The difference between two values in logarithmic form is a measure of percentage change (%Δ) in the factor.

With the calculation of the q^{SFR}_{actual}, the factor elasticities and the percent changes in factors, the normalized value of household demand in logarithmic form can be calculated using the following equation:

$$\ln(q^{SFR}_{normal}) = \ln(q^{SFR}_{actual}) + (\varepsilon_{inc} \times \%\Delta income) + \left(\varepsilon^{SFR}_{rain} \times \%\Delta rain\right) + \left(\varepsilon^{SFR}_{rain} \times \%\Delta temp\right)$$

(eq. 4)

The normalized monthly household demand in levels is given by

$$q^{SFR}_{normal} = e^{\ln(q^{SFR}_{normal})} \qquad \text{(eq. 5)}$$

The aggregate SFR demand is given by

$$Q^{SFR}_{normal} = \#\ of\ SFR\ accounts\ \times q^{SFR}_{normal} \qquad \text{(eq. 6)}$$

6.2 Detailed Description of Calculation for CI Baseline Demand Adjustment

The CI baseline demand adjustment is similar to the SFR calculation with the following exceptions:

- The demand variable is consumption per employee.
- The relevant demand factors conditioning the normalization are only precipitation and average summer daily maximum temperature, which reflects the distribution of employment across zip codes in CCSF.
- The relevant demand factor elasticities are based on the CI demand regression results.
- Aggregate normalized demand is calculated by multiplying by normalized employment levels, which corresponds to average employment in 2005, 2006 and 2007.

Thus, the normalized value of CI demand in logarithmic form can be calculated using the following equation:

$$\ln(q_{normal}^{CI}) = \ln(q_{actual}^{CI}) + (\varepsilon_{rain}^{CI} \times \%\Delta rain) + \left(\varepsilon_{temp}^{CI} \times \%\Delta temp\right) \qquad \text{(eq. 7)}$$

The normalized consumption per employee in levels is given by

$$q_{normal}^{CI} = e^{\ln(q_{normal}^{CI})} \qquad \text{(eq. 8)}$$

The aggregate CI demand is given by

$$Q_{normal}^{CI} = Average\ Employment\ in\ 2005 - 2007 \times q_{normal}^{CI} \qquad \text{(eq. 9)}$$

7 DEMAND PROJECTIONS THROUGH FY2039-40

The method for forecasting FY2039-40 demand begins with the adjusted demands in FY2010-11 and adds an incremental amount of demand based on (i) growth in demand drivers and factors between the year 2010 and 2040 and (ii) the estimated elasticities for each of the demand factors resulting from the sectorial regression models. The demand drivers included in the forecast models are the number of SFR and MFR housing units and employment; the demand factors considered are household income and price.

Overall, the method for calculating the demand forecasts is similar to the method used for the demand normalization exercise with the following exceptions:

- 2010 baseline demand is considered the adjusted "normalized" demand rather than the actual demand for FY2010-11 (i.e., incremental FY2039-40 demand is relative to this normalized demand level).
- Normalized demand assumes historical weather patterns, which are also assumed for the year 2040. Therefore, the weather variables are no longer among the changing demand factors.
- Price is projected to increase in the future and so is considered among the changing demand factors.
- To recover aggregate demand in FY2039-2040 in the SFR and CI sectors, the predicted SFR household and employee demands are multiplied by the year 2035 projections of SFR accounts and employees, respectively.
- Because price enters as a changing factor, the MFR sector is expected to respond according to the elasticity estimated in the MFR demand regression. Thus, the MFR future demand is not held constant.
- Due to lack of historical data on MFR households, MFR household level demand cannot be estimated using the regression results. Instead, the aggregate demand estimate (under the year 2040 price conditions) are escalated according to the projected growth in MFR households.

It should also be noted that the demand forecasts are not intended to quantify the following:

- The demand model does not directly incorporate conservation-related codes, standards, or ordinances, nor does it explicitly quantify passive conservation savings. However, because demands are driven by socioeconomic factors, such as the price of water, passive conservation is imbedded in the demand projections.

For instance, as the price of water increases homeowners will respond by reducing consumption; a natural choice for this reduction are conservation measures like the adoption of water efficient fixtures and/or other water efficiency standards. As a consequence, the demand projections are assumed to reflect passive conservation.

- Active conservation savings (i.e., water savings due to conservation programs beyond codes, standards, and ordinances) are forecasted separately by the SFPUC.
- SFPUC water accounts classified as "Suburban," "Combination", "Fire" and "Irrigation" accounts are not included in the sectorial regression models described in this document (see Appendix A for a full list). Demands for these classes are forecasted separately by the SFPUC.
- Water loss and non-revenue and unmetered demands resulting from distribution system leaks, breaks, flushing, firefighting, steet cleaning, etc. are estimated separately by the SFPUC.

Table 5 presents the anticipated growth for SFR households, MFR households, employment and median household income for CCSF. Growth in retail water rates are reported in Table 6.

Table 5. Summary of Projected Growth in the Demand Factors Used to Generate Demand Projections

	Fiscal Year					
	2014-15	2019-20	2024-25	2029-30	2034-35	2039-40
Number of Households[1]	361,452	377,684	393,630	410,227	426,235	442,905
Single Family Households[2, 3]	112,109	113,475	114,857	116,257	117,674	119,108
Multi Family Households[4]	249,343	264,209	278,773	293,970	308,561	323,797
Number of Jobs[5]	621,772	677,531	691,342	706,848	733,858	766,955
Percentage Growth in Median Household Income relative to FY2010-11[6]	3.0%	7.4%	12.2%	17.7%	23.3%	28.8%

Notes:

1. Projected number of in-city households is from the San Francisco Planning Department's Land Use Allocation (LUA) 2012.
2. Historic number of single family households is equivalent to the number of City Paying Single-family accounts in SFPUC's billing system (CC&B).
3. Projected number of single family households is based on average growth rate for 1990-2010.
4. Multi family households is calculated as the difference between total households and single family households.
5. Number of in-city jobs is from the San Francisco Planning Department's Land Use Allocation (LUA) 2012.
6. Refer to ABAG Projections 2009. For FY2039-40, growth is extrapolated FY2014-15 to FY2034-35 projections.

Table 6. Summary of Price Projections

Fiscal Year	Projected CPI assuming 2% inflation[a]	SFPUC Retail-- Nominal Prices	SFPUC Retail-- rate projections	SFPUC Retail-- 2010 Real Prices	CPI conversion factor	SFPUC Retail-- 2000 Real Prices
2010-11	$218.06	$4.12		$4.12	0.79	$3.25
2014-15	$238.87	$6.52	6.5%	$5.95	0.79	$4.70
2019-20	$263.73	$10.43	10.0%	$8.62	0.79	$6.81
2024-25	$291.18	$13.17	3.0%	$9.86	0.79	$7.79
2029-30	$321.49	$14.68	2.0%	$9.96	0.79	$7.87
2034-35	$354.95	$16.21	2.0%	$9.96	0.79	$7.87
2039-40	$391.89	$17.90	2.0%	$9.96	0.79	$7.87

Source: Federal Reserve. "Economic Projections of Federal Reserve Board Members and Federal Reserve Bank Presidents, December 2012", (http://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20121212.pdf)

Appendix A

Billing Class by Sector

Sector	Billing Class
Single Family Residential	Single Family Residential
Multi-Family Residential	Multi-Family Residential
Commercial and Industrial	Builders & Contractors Commercial Docks & Ships Industrial
Not included in sectorial regression models	Suburban accounts (including airport, San Bruno Jail, Sharp Park, Lawrence Livermore National Laboratory) Irrigation accounts Fire service accounts Combination accounts Non-potable accounts Municipal accounts Treasure Island

APPENDIX B

The data used to generate the demand projections come from several sources, we summarize these data sources below:

- **SFPUC Customer Care & Billing System (CC&B):** Unadjusted baseline 2010 consumption data is based on observed consumption by sector. See Appendix A for how SFPUC billing classes are aggregated into the SFR, MFR and CI sectors.
- Adjustments to baseline consumption due to atypical demand conditions in the year 2010 rely on the following sources:
    - **PRISM Climate Group[14]:** Weather data to measure 2010 deviation from historical climate in the CCSF service area.
    - **California Employment Development Department:** Employment data to measure 2010 deviation from historical average employment between 2005-2007.
    - **American Community Survey, U.S. Census:** 2010 median household income to measure 2010 deviation from historical average income between 2005-2007.
- Projected changes in consumption by sector rely on the following sources:
    - **SFPUC CC&B:** Number of SFR accounts to approximate number of SFR households. Number of MFR households is calculated as the difference between total households and SFR households. See Table 5.
    - **Department of Finance E-8 data:** Total number of households is obtained from the Department of Finance. This is combined with the administrative data from SFPUC on the number of SFR accounts to recover an estimate of households in the MFR sector. See Table 5.
    - **San Francisco Planning Department's Land Use Allocation (LUA) Plan 2012:** Number of jobs. See Table 5.
    - **ABAG Projections 2009[15]:** Median household income in five year increments through the year 2035. The year 2040 projection was extrapolated using the 2015-2035 projections.
    - **SFPUC Division of Finance:** Nominal rate projections in five year increments between 2010 and 2040. All nominal rate projections were converted to the year 2010 real prices using the Bureau of Labor Statistics consumer price index (CPI)

---

[14] PRISM Climate Group, "Near-Real-Time Monthly High-Resolution Precipitation Climate Data Set for the Conterminous United States", raster digital data, accessible: http://www.prism.oregonstate.edu/.

[15] Association of Bay Area Governments (ABAG), Building Momentum: Projections and Priorities 2009 (*Projections 2009)*, August 2009.

and by assuming 2% inflation based economic projections prepared by the Federal Reserve[16]. See Table 6.

- o **BAWSCA Annual Surveys (FY1995-96 through FY2010-11):** Historical data on annual SFR and MFR consumption and metered accounts in non-CCSF utility service areas.

- **The Brattle Group:** Estimated regression coefficients that relate price and income to consumption. See discussion in sections 2, 3, 4 and 5 for more details on the historical data used to develop the regression models.

---

16 Source: Federal Reserve. "Economic Projections of Federal Reserve Board Members and Federal Reserve Bank Presidents, December 2012", (http://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20121212.pdf).

CAMBRIDGE
NEW YORK
SAN FRANCISCO
WASHINGTON
LONDON
MADRID
ROME

THE Brattle GROUP

APPENDIX F

2015-2016 Drought Program

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission
April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

SAN FRANCISCO PUBLIC UTILITIES COMMISSION

2015-2016 DROUGHT PROGRAM
May 2015, amended June 2015

SECTION 1. INTRODUCTION AND BACKGROUND

California is currently experiencing its fourth year of drought, which may continue into a fifth year and beyond. The State Water Resources Control Board (State Water Board) has taken a series of actions to address the increasing severity of water supply conditions across the State. Many of these actions impose specific restrictions on urban water suppliers and outdoor water use. The City and County of San Francisco and the San Francisco Public Utilities Commission (SFPUC) have also taken action to respond to the drought not only by implementing the State's directives locally, but also by adopting regulations of its own. A selection of State and local actions are summarized on the next page.

Even before the onset of the current drought, San Francisco had one of the lowest per capita water uses in the State thanks to the successful implementation of water conservation over several decades. The longevity of conservation in San Francisco has also resulted in hardening of indoor demands. During the period of June 2014 through February 2015 – the period that was evaluated by the State Water Board in developing a framework for the mandatory Statewide 25% reduction – SFPUC reduced retail water deliveries by about 8% as compared to the same period in 2013. This reduction is substantial given how difficult it is to reduce not just indoor water use, but also outdoor water use in a dense urban area with relatively low outdoor water use to begin with. Also during this period, residential water use has consistently been one of the lowest in the State hovering around 45 gallons per capita per day. Taking these achievements into consideration, the State Water Board placed the SFPUC in an 8% conservation standard tier, the lowest tier in its May 2015 emergency regulations.

The State Water Board may issue information orders, conservation orders, or cease and desist orders to water suppliers who do not meet their assigned conservation standard. Violation of cease and desist orders are subject to a civil liability of up to $10,000 a day.

A Brief Timeline of State and Local Drought Actions

State	San Francisco
January 17, 2014 The Governor declares a drought State of Emergency (Proclamation 1-17-2014).	**January 31, 2014** The SFPUC asks all customers to voluntarily curtail water consumption by at least 10% system-wide. (Press Release 3-14)
	February 10, 2014 The Mayor directs City departments to reduce water consumption by 10%. (Executive Directive 14-01)
April 25, 2014 The Governor declares a Continued State of Emergency and calls on all Californians to redouble their efforts to conserve water.	
July 15, 2014 The State Water Board adopts emergency regulations requiring urban water suppliers to impose mandatory restrictions on outdoor irrigation. (Resolution 2014-0038)	**August 12, 2014** The SFPUC imposes a mandatory 10% reduction on outdoor irrigation consistent with the State Water Board's emergency regulations. (Resolution 14-0121)
	August 26, 2014 The SFPUC adopts regulations and restrictions for administering allocations and excess use charges on irrigation customers. (Resolution 14-0140)
March 17, 2015 The State Water Board adopts an update to its emergency regulations with additional water use restrictions. (Resolution 2014-0013)	
April 1, 2015 The Governor directs the State Water Board to implement a mandatory Statewide water reduction of 25% among other directives and prohibitions. (Executive Order B-29-15)	**April 28, 2015** The SFPUC imposes additional water use restrictions consistent with the State Water Board's emergency regulations. (Resolution 15-0102)
May 5, 2015 The State Water Board adopts an update to its emergency regulations, including conservation standards for all urban water suppliers and additional prohibitions. A conservation standard of 8% is assigned to the SFPUC. (Resolution 2015-0032)	**May 26, 2015** The SFPUC adopts the 2015-2016 Drought Program described herein (Resolution 15-0119).
	June 23, 2015 The SFPUC amends rules and regulations for interruptible water service as part of the 2015-2016 Drought Program described herein. (Resolution 15-0149)

SECTION 2. PROGRAM OBJECTIVES

The objectives of the 2015-2016 Drought Program ("Program") are to:

1. Effective June 1, 2015, **reduce retail system-wide water use by 10%** as compared to the corresponding baseline period in 2013;
2. Effective July 1, 2015, **reduce retail potable[1] water outdoor irrigation by 25%** as compared to the corresponding baseline period in 2013;
3. Effective July 1, 2015, adjust existing wastewater flow factors to reflect a 25% reduction in irrigation; and
4. Prohibit water use practices that are wasteful and/or unnecessary for health and safety.

The Program will be in effect until the water shortage emergency is lifted by the General Manager. In addition, the SFPUC will continually evaluate whether or not the above objectives are being met and if more stringent measures will need to be taken.

Specific Program components that will meet the above objectives are described in the following sections.

SECTION 3. REDUCTION FOR NON-IRRIGATION CUSTOMERS

3.1 Description of Program Component

All non-irrigation accounts in the SFPUC retail service area must strive to reduce water use by 10% as compared to 2013. This goal is in effect starting June 1, 2015 and will remain in effect until the water shortage emergency is lifted by the General Manager .

3.2 Implementation

This water use reduction will be communicated to all customers through a multi-faceted outreach plan that is briefly described in Section 7, Communications and Outreach. One of the communications tools that is currently available to SFPUC customers is My Account, SFPUC's web self-service application. My Account shows each customer his or her account's daily water usage in a chart. For the current drought, a "Drought Water Use Target" bar will be added to the chart to show an average daily water usage that the customer should be striving to meet.

---

[1] Raw water accounts that serve dedicated irrigation are subject to the 25% reduction because raw water is not a drought-resistant supply. Raw water accounts receive untreated water from the SFPUC Regional Water System to serve non-potable purposes.

SECTION 4. REDUCTION FOR DEDICATED IRRIGATION CUSTOMERS

4.1 Description of Program Component

In August 2014, the SFPUC imposed a mandatory reduction of 10% on outdoor irrigation of ornamental landscapes or turf with potable water by retail customers. To enforce this reduction, the SFPUC assigned monthly water use allocations to approximately 1,600 dedicated irrigation accounts in its retail service area. Allocations were set to 90% of an account's water use from the corresponding billing month in 2013.The effective period, or restriction period, of this 10% Mandatory Allocation Program began with the October 2014 billing period for each affected account and continues through the June 2015 billing period. For each account that exceeds its allocation during the course of the restriction period, a one-time excess use charge will be applied on its June 2015 bill.

Starting July 1, 2015, the reduction will be increased from 10% to 25%. Allocations will be set to 75% of an account's water use from the corresponding billing month in 2013. Any excess use charges incurred will be applied on a monthly (i.e., billing period) basis instead of one time at the end of the restriction period. This 25% reduction will remain in effect until the water shortage emergency is lifted by the General Manager.

For the initial 10% Mandatory Allocation Program, only accounts that were classified in the SFPUC billing system as dedicated irrigation accounts were automatically included unless exempted. However, upon further investigation by SFPUC staff and due to increased focus by the State Water Board on reducing outdoor irrigation, accounts that are not classified as dedicated irrigation but are identified to be serving irrigation for the majority of their water use may be included in the 25% Mandatory Allocation Program. For instance, a golf course with a commercial water account that serves mainly irrigation uses may be identified as being subject to the 25% mandatory reduction. Inclusion of such accounts in the 25% Mandatory Allocation Program will be at the discretion of the General Manager. If an account is identified for inclusion, the SFPUC will notify the account holder in advance.

For both the 10% and 25% reduction periods, allocations and excess use charges are applied at the account level except for accounts held by City and County of San Francisco departments. For these municipal irrigation accounts, a department's account allocations are aggregated and applied at the department level.

For the regulations pertaining to the 25% reduction and resulting allocations and excess use charges, refer to the amendments adopted by the Commission on May 26, 2015, Resolution 15-0119. These regulations amend those that were adopted by the Commission on August 26, 2014, Resolution 14-014, for the initial 10% reduction.

4.2 Interruptible Water Service

Rules and regulations for Interruptible Water Service were adopted by the SFPUC in February 2015 to allow participating dedicated irrigation customers to receive water

service at a reduced rate, which is about 9% lower than regular commercial water rates. By opting into the Interruptible Water Service Program, customers are subject to service interruption and/or greater mandatory water use reductions, along with greater excess use charges, during water shortages and other emergencies at the discretion of the SFPUC Water Enterprise.

The rules and regulations for Interruptible Water Service describe excess use charges applicable during each stage of a water shortage emergency as outlined in SFPUC's Retail Water Shortage Allocation Plan. During Stage 1, corresponding to a system-wide reduction of 5-10%, Interruptible Water Service customers would be subject to a 10% mandatory water use reduction and associated excess use charges of 200% ("2x") of the applicable water rate. During Stage 2, corresponding to a system-wide reduction of 11-20%, Interruptible Water Service customers would be subject to a 25% reduction and corresponding excess use charges of 400% ("4x").

The Interruptible Water Service Program will continue while the 2015-2016 Drought Program is in effect. However, the 2015-2016 Drought Program does not neatly align with Stage 1 or Stage 2 as described in the rules and regulations. Therefore, as an amendment to the rules to reflect the current drought conditions for which a 10% system-wide reduction and 25% irrigation reduction will be in effect, Interruptible Water Service customers shall be subject to a more stringent 30% reduction and excess use charges of 300% ("3x") of the applicable water rate. In comparison, dedicated irrigation customers not participating in the Interruptible Water Service Program are subject excess use charges of 100% ("1x").

For the complete rules and regulations pertaining to Interruptible Water Service, refer to the amended rules and regulations adopted by the Commission on June 23, 2015, Resolution 15-0149.

4.3 Exceptions and Appeals

A customer may appeal for an exemption or a revised allocation if his or her account meets any of the criteria below by completing and submitting an Irrigation Allocation Appeals Form, which is available at sfwater.org. Appeals will be received and reviewed by the SFPUC Water Conservation Section. For the complete regulations pertaining to exceptions, refer to the amended excess use charge regulations adopted by the Commission on May 26, 2015, Resolution 15-0119.

Criteria to appeal for an exemption:

1. Irrigation demand consists of 100% edible plantings for individual consumption or commercial purposes;
2. Irrigation demand served by raw water consists of 100% plantings grown for commercial sales, such as nurseries and tree farms;
3. Irrigation demand consists of 100% community gardens or demonstration projects that are accessible or beneficial to the community and public; or

4. Irrigation demand is provided by recycled water.

Criteria to appeal for a revised allocation:

1. Circumstances concerning the customer's irrigation practices have changed during the baseline period or since the implementation of the 25% reduction, warranting a modification to the customer's water use allocation; or
2. The customer oversees multiple irrigation accounts that are subject to mandatory reductions and opts to redistribute the account-level allocations among the irrigation accounts to achieve the same overall reduction. Each of the following criteria must be met:
   a. The properties must be owned by one entity;
   b. Each account in the group must serve a hospital, university, cemetery, State or Federal governmental facility, or otherwise serve a space that is accessible or beneficial to the community and public; and
   c. Each account in the group must comply with applicable outdoor water use restrictions.

4.4 Implementation

Allocations and excess use charges will be administered by the SFPUC Customer Service Bureau through the Customer Care and Billing (CC&B) system. Inquiries from customers about allocations, methodologies, baseline water use data, and the appeals process will also be addressed by the SFPUC Customer Service Bureau.

The SFPUC will send each dedicated irrigation customer a notification letter of their monthly allocations for July 2015 through February 2016. It is anticipated that the letters will be sent to customers in early June 2015 to allow time for customers to review their allocations and potentially appeal before the 25% reduction takes effect on July 1, 2015. Revised and/or additional allocations will be sent to customers should the drought conditions change or continue beyond February 2016.

4.5 Enforcement

The 25% reduction will be enforced through administration of allocations and excess use charges. Flow restrictions and shut offs are not included in the Program at this time, but may be subject to change.

SECTION 5. FLOW FACTOR ADJUSTMENT

5.1 Description of Program Component

In addition to calling for all non-irrigation customers to reduce water use by 10%, customers presently receiving reduced wastewater flow factors will also be required to reduce irrigation water use by 25%. Accordingly, these reduced wastewater flow factors

will be adjusted to reflect an anticipated 25% reduction in outdoor irrigation water use. This flow factor adjustment is intended to help meet the Program objective of reducing retail potable water irrigation by 25% by holding non-irrigation customers accountable for their outdoor water use. Adjusted flow factors will be in effect starting July 1, 2015 and remain in effect until the water shortage emergency is lifted by the General Manager. Furthermore, this 25% reduction of irrigation of water use will also apply to new wastewater flow factor appeals during this restriction period.

Sewer service accounts are charged a sewer rate based on a flow factor. A flow factor represents the portion of water consumed that is discharged to the sewer system as wastewater. When a new account is opened, the SFPUC assigns a standard flow factor of 90% to single family residential accounts, 95% to multi-family residential accounts, and 90% to non-residential accounts. However, a customer may appeal to reduce his or her assigned flow factor if the customer can substantiate that less than the assumed standard water use is discharged to the sewer system. Customers with reduced flow factors tend to be those with large irrigation use, but non-residential customers may also appeal due to non-irrigation use such as recirculating water used in cooling towers. Currently, approximately 14,000 residential accounts and 400 non-residential accounts have reduced flow factors.

For the duration of the 2015-2016 Drought Program, reduced flow factors will be adjusted as follows. Adjusted flow factors will be rounded down to the nearest whole integer.

- For single family residential and non-residential customers:

  Adjusted Flow Factor = (90% - Reduced Flow Factor) x (% Mandatory Reduction) + Reduced Flow Factor

- For multi-family residential customers:

  Adjusted Flow Factor = (95% - Reduced Flow Factor) x (% Mandatory Reduction) + Reduced Flow Factor

An example of a flow factor adjustment is provided below:

A multi-family residential customer currently has a flow factor of 80%. A 25% mandatory reduction on irrigation is in effect.

Adjusted Flow Factor = (95% - Reduced Flow Factor) x (% Mandatory Reduction) + Reduced Flow Factor

= (95% - 80%) x 25% + 80%

= 83.75%

= 83% (rounded down to nearest whole integer)

For the complete rules pertaining to the residential flow factor appeals process, refer to the amendments adopted by the Commission on May 26, 2015, Resolution 15-0119. These regulations amend those that were adopted by the Commission on June 10, 2003, Resolution 03-0112. Non-residential customers may also appeal the standard flow factor of 90% using similar criteria.

5.2 Exceptions and Appeals

Customers who currently have reduced flow factors may be exempted from adjustments or may submit an appeal if any of the following criteria apply:

1. A residential customer with irrigation demand consisting of 100% edible plantings for individual consumption or commercial purposes; or
2. A non-residential customer with a reduced flow factor due to non-irrigation water use such as cooling towers.

New appeals for reduced flow factors must provide proof of compliance with San Francisco's Water Efficient Irrigation Ordinance (Administrative Code, Chapter 63) if over 1,000 square feet of landscape have been modified or newly installed since January 2011.

5.3 Implementation

Flow factor adjustments will be administered by the SFPUC Customer Service Bureau through the Customer Care and Billing (CC&B) system. Adjustments will be effective-dated so that a recorded history is maintained. When the restriction period ends, flow factors may be reverted back to the values that were in place prior to July 1, 2015.

The SFPUC will send all affected customers a notification letter of their flow factor adjustments. It is anticipated that the letters will be sent to customers in early June 2015 to allow time for customers to review their adjustments and potentially appeal before the adjusted flow factors take effect on July 1, 2015.

Inquiries from customers about the adjustment method and the appeals process will be addressed by the SFPUC Customer Service Bureau.

SECTION 6. WATER USE RESTRICTIONS

6.1 Description of Program Component

Permanent water use restrictions have been in place in the SFPUC retail service area since before the current drought. Due to the increasing severity of the drought and in response to the end-user requirements by the State Water Board, the SFPUC has adopted additional mandatory restrictions to impose the State's prohibitions in the SFPUC retail service area if they had not already been addressed by existing SFPUC water use

restrictions. At this time, the additional restrictions are temporary and in effect until the General Manager declares that the water shortage emergency is over.

All retail paying and nonpaying customers within and outside of the City and County of San Francisco, including but not limited to federal, state, and local governments, shall be in violation of the SFPUC's Water Use Restrictions, if the customer is found to be using water excessively in the following ways:

Permanent Restrictions	**Effective Date and Resolution(s)**
(a) Water waste, including but not limited to, any flooding or runoff into the street, sidewalk or gutter	January 1, 1960 (SFPUC Resolution 19.786)
(b) Using hoses for any purpose without a positive shut-off valve	
(c) Serving water at a restaurant, café or food counter without waiting for a request by a customer or customers	
(d) Use of potable water for consolidation of backfill, dust control or other nonessential construction purposes if groundwater or reclaimed water is available and approved by the Department of Health	
(e) Use of single-pass cooling systems, fountains and commercial car washes	

Temporary Restrictions **(mandatory until the water shortage emergency is lifted by the General Manager)**	**Effective Date and Resolution(s)**
(f) Washing sidewalks, driveways, plazas and other outdoor hardscapes for reasons other than health and safety needs	July 28, 2014 (State Water Board Resolution 2014-0038)
(g) Outdoor irrigation of ornamental landscapes or turf with potable water that is not reduced by at least ten percent (10%)	August 12, 2014 (SFPUC Resolution 14-0121)
(h) Watering outdoor landscapes with potable water during and within forty-eight (48) hours after a rain event	March 17, 2015 (State Water Board Resolution 2015-0013); April 28, 2015 (SFPUC Resolution 2015-0102)
(i) Not providing guests the option to refuse daily laundering of towels and linens at hotels and motels, and not prominently displaying notice of this option in each guestroom	
(j) Irrigation with potable water of ornamental turf on public street medians	May 5, 2015 (State Water Board Resolution 2015-0032); May 26, 2015 (SFPUC Resolution 15-0119)

It should also be noted that in addition to the above water use restrictions, the City and County of San Francisco has policies and ordinances already in place that encourage the reduction of potable water use. More information about these ordinances is available at sfwater.org/reqs.

- Residential Water Conservation Ordinance (Housing Code, Chapter 12A)
- Commercial Water Conservation Ordinance (Building Code, Article 13A)
- Water Efficient Irrigation Ordinance (Administrative Code, Chapter 63)
- Recycled Water Use Ordinance (Public Works Code, Article 22)
- Restriction of Use of Potable Water for Soil Compaction and Dust Control Activities Ordinance (Public Works Code, Article 21)
- Alternate Water Sources for Non-potable Applications Ordinance (Health Code, Article 12C)

6.4 Exceptions and Appeals

As stated above under item (f), using water to wash sidewalks and hardscapes is prohibited except to address immediate health and safety needs. Otherwise, no exceptions to the above restrictions are allowed.

6.5 Implementation

Through the Retail Water Shortage Allocation Plan, the SFPUC may impose any additional water use prohibitions applicable to retail customers regardless of whether or not the prohibitions were mandated by the State. The SFPUC will continue to inform customers of the water use restrictions through sfwater.org, flyers, postcards, community meetings, the media, etc. See Section 7, Communications and Outreach, or other methods of communication through which the water use restrictions will be shared. Preparation and dissemination of resources and materials will be facilitated by the SFPUC Water Conservation Section, Customer Service Bureau, and Communications Department.

6.6 Water Waste Reporting

A public system for reporting incidents of potential water waste is maintained through sf311.org and the 311 service request call line. The SFPUC reviews reports of potential water waste submitted through 311. If the report contains sufficient information and reflects a restricted outdoor water use, the SFPUC issues a written notice to the water account holder, property owner, and occupant. If reports of waste continue, the SFPUC will call or visit the site to try to verify waste. If water waste is verified and continues, the SFPUC will issue additional warning letters to the account holder. Account holders that receive multiple warnings of verified water waste may be subject to additional action.

SECTION 7. COMMUNICATIONS AND OUTREACH

Customers will be informed of the Program components through a variety of ways. Planned outreach and communication activities include both holistic as well as targeted outreach. These activities include, but are not limited to, the following.

7.1 Ongoing Communications

The SFPUC will continue to communicate water use restrictions through sfwater.org, flyers, postcards, community meetings, the media, etc. The SFPUC will also continue efforts to promote retrofits of plumbing fixtures through its incentive programs. San Francisco's water efficiency requirements and related ordinances will continue to be communicated to the development community and implemented through existing planning and building review processes.

7.2 Notification of Allocations and Adjustments

The SFPUC will send notification letters to irrigation customers, both private and municipal, regarding the 25% reduction and resulting allocations. Letters will also be sent to customers with reduced flow factors notifying them of the forthcoming flow factor adjustment.

7.3 Top Users by Customer

The SFPUC will conduct targeted outreach to top water users, focusing on those who have not participated in SFPUC's conservation incentive programs in the past and have increased water usage since 2013. It is important to note that for this group of customers, high water use does not necessarily mean inefficient water use or that reducing use would be feasible. This outreach will help the SFPUC better understand the water use practices of these top customers and serve as a continuation of ongoing efforts to educate customers about water efficiency and the tools, services, and incentives the SFPUC provides. In-City retail customers will be encouraged to sign up for My Account to track their account's water use and how it relates to a 10 percent reduction over 2013 use.

In addition, SFPUC will continue to work regularly with City departments who were required to submit water conservation plans and plumbing fixture inventories to the SFPUC. Soon the SFPUC will launch a new direct installation program targeted at replacing inefficient plumbing fixtures in City-owned facilities. SFPUC will continue to issue departments periodic updates on their overall department and account-specific progress toward reducing water usage by 10% for standard water service accounts and 25% for irrigation accounts.

The SFPUC will also send letters to top single family and multi-family residential customers notifying them that their usage is among the top of their customer class and building size. Through these letters, the SFPUC will request that these customers evaluate

and try to lower their usage, and encourage them to sign up for My Account and to contact the SFPUC for conservation assistance.

7.4 Top Users by Sector

In addition to direct customer-specific contact, the SFPUC will continue and expand efforts to provide information about the drought and ways to save to high water-using business sectors and business sectors for which water is a major part of their operations or whose water use could increase during the drought. Specific sectors that will be targeted include hotels, restaurants, office buildings, laundromats, beauty salons, car washes, and gyms.

7.5 Leak Detection and Notification

The SFPUC launched a pilot Leak Detection Program in April 2015 to notify single family residential customers about potential plumbing leaks that may be occurring at their homes. The SFPUC analyzes hourly water consumption data collected through its automated meter reading system. If continuous water usage is recorded every hour for a 3-day period, the SFPUC will send a courtesy postcard to notify the customer that he or she may have a leak.

7.6 My Account

Customers are encouraged to sign up for and track their water use through My Account, the SFPUC's on-line bill management system. My Account provides a chart showing the customer account's daily water usage. For the current drought, a "Drought Water Use Target" bar will be added to the chart to show an average daily water usage that the customer should be striving to meet. This target bar represents 90% of the account's average water use during the months of January, February, and June through December of 2013. If the customer's account was not open during these months in 2013, the target bar will represent 90% of the average water use for their account type (e.g., single family residential, multi-family residential, and non-residential). For dedicated irrigation accounts, the target bar will represent 75% of the average water use. The target bar is anticipated to be launched in June 2015 and will remain active through February 2016. As with the overall the 2015-2016 Drought Program, the target bar is subject to change.

7.7 Fractional Billing

Currently, SFPUC customers are billed in whole units, where one unit equals 748 gallons or 100 cubic feet or 1 CCF. A typical home may consume between 1 and 2 units per month or less. Because the billing units are rounded up or down to the whole unit, real-time and incremental savings cannot be communicated to the customer through their monthly bills. The SFPUC is preparing to implement fractional billing into CC&B so that customers will be billed for their actual water consumption and can view their water use down to the 0.01 unit or 1 cubic foot level on their bills. Implementation of fractional billing is anticipated for January 2016.

APPENDIX G

In-City Retail Water Audit Worksheet (Draft)

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

AWWA Free Water Audit Software v5.0

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person:	Chris Hewes and Ryker Brown	
Email Address:	chewes@rmcwater.com and rbrown@rmcwater.com	
Telephone | Ext.:	415-321-3422	
Name of City / Utility:	San Francisco Public Utilities Commission	
City/Town/Municipality:	San Francisco	
State / Province:	California (CA)	
Country:	USA	
Year:	2015	Financial Year
Start Date:	07/2014	Enter MM/YYYY numeric format
End Date:	06/2015	Enter MM/YYYY numeric format
Audit Preparation Date:	2/9/2016	
Volume Reporting Units:	Million gallons (US)	
PWSID / Other ID:		

The following guidance will help you complete the Audit

All audit data are entered on the ***Reporting Worksheet***

- Value can be entered by user
- Value calculated based on input data
- These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions
The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet
Enter the required data on this worksheet to calculate the water balance and data grading

Comments
Enter comments to explain how values were calculated or to document data sources

Performance Indicators
Review the performance indicators to evaluate the results of the audit

Water Balance
The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard
A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix
Presents the possible grading options for each input component of the audit

Service Connection Diagram
Diagrams depicting possible customer service connection line configurations

Definitions
Use this sheet to understand the terms used in the audit process

Loss Control Planning
Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits
Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements
Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at wlc@awwa.org

AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0

? Click to access definition
\+ Click to add a comment

Water Audit Report for: San Francisco Public Utilities Commission
Reporting Year: 2015 | 7/2014 - 6/2015

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<---------- Enter grading in column 'E' and 'J' ---------->

WATER SUPPLIED

	Grade	Value	Units	Master Meter and Supply Error Adjustments: Grade	Pcnt:	Value:	
Volume from own sources:	10	23,363.680	MG/Yr	8	0.00%		MG/Yr
Water imported:	n/a	0.000	MG/Yr				MG/Yr
Water exported:	n/a	0.000	MG/Yr				MG/Yr
WATER SUPPLIED:		**23,363.680**	MG/Yr				

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

	Grade	Value	Units	Pcnt:	Value:	
Billed metered:	9	21,088.150	MG/Yr			
Billed unmetered:	n/a	0.000	MG/Yr			
Unbilled metered:	10	264.170	MG/Yr			
Unbilled unmetered:	8	74.960	MG/Yr		74.960	MG/Yr
AUTHORIZED CONSUMPTION:		**21,427.280**	MG/Yr			

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption)

1,936.400 MG/Yr

Apparent Losses

	Grade	Value	Units	Pcnt:	Value:	
Unauthorized consumption:	6	29.205	MG/Yr		29.205	MG/Yr
Customer metering inaccuracies:	7	438.828	MG/Yr		438.828	MG/Yr
Systematic data handling errors:	9	13.180	MG/Yr		13.180	MG/Yr
Apparent Losses:		**481.213**	MG/Yr			

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:	**1,455.187**	MG/Yr
WATER LOSSES:	**1,936.400**	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: **2,275.530** MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

	Grade	Value	Units
Length of mains:	8	1,241.0	miles
Number of active AND inactive service connections:	7	174,854	
Service connection density:		141	conn./mile main

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line: (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

	Grade	Value	Units
Average operating pressure:	7	76.1	psi

COST DATA

	Grade	Value	Units
Total annual cost of operating water system:	9	$268,504,152	$/Year
Customer retail unit cost (applied to Apparent Losses):	9	$14.38	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	8	$285.47	$/Million gallons

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 90 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Customer metering inaccuracies
2: Unauthorized consumption
3: Variable production cost (applied to Real Losses)

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

Water Audit Report for: San Francisco Public Utilities Commission

Reporting Year: 2015 | 7/2014 - 6/2015

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 90 out of 100 *****

System Attributes:

Apparent Losses:	481.213	MG/Yr
+ Real Losses:	1,455.187	MG/Yr
= **Water Losses:**	**1,936.400**	MG/Yr
Unavoidable Annual Real Losses (UARL):	915.49	MG/Yr
Annual cost of Apparent Losses:	$9,250,486	
Annual cost of Real Losses:	$415,412	Valued at **Variable Production Cost** Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	9.7%	
	Non-revenue water as percent by cost of operating system:	3.6%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	7.54	gallons/connection/day
	Real Losses per service connection per day:	22.80	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.30	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	1,455.19	million gallons/year
	Infrastructure Leakage Index (ILI) [CARL/UARL]:	1.59	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software: Water Balance

WAS v5.0

Water Audit Report for:	San Francisco Public Utilities Commission	
Reporting Year:	2015	7/2014 - 6/2015
Data Validity Score:	90	

Own Sources (Adjusted for known errors) 23,363.680	System Input 23,363.680	Water Exported 0.000			Billed Water Exported	Revenue Water 0.000
		Water Supplied 23,363.680	Authorized Consumption 21,427.280	Billed Authorized Consumption 21,088.150	Billed Metered Consumption (water exported is removed) 21,088.150	Revenue Water 21,088.150
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 339.130	Unbilled Metered Consumption 264.170	Non-Revenue Water (NRW) 2,275.530
					Unbilled Unmetered Consumption 74.960	
			Water Losses 1,936.400	Apparent Losses 481.213	Unauthorized Consumption 29.205	
					Customer Metering Inaccuracies 438.828	
					Systematic Data Handling Errors 13.180	
Water Imported 0.000				Real Losses 1,455.187	Leakage on Transmission and/or Distribution Mains *Not broken down*	
					Leakage and Overflows at Utility's Storage Tanks *Not broken down*	
					Leakage on Service Connections *Not broken down*	

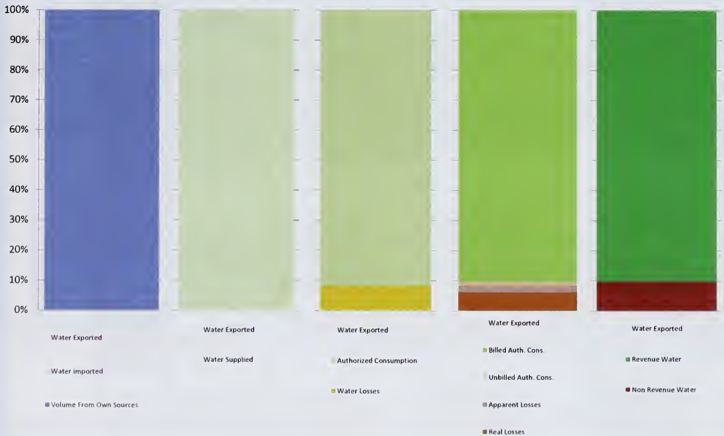
AWWA Free Water Audit Software: Dashboard

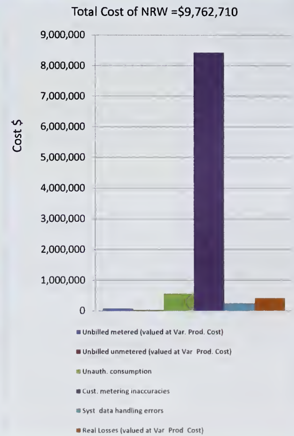
WAS v5.0
American Water Works Association.

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

Water Audit Report for:	San Francisco Public Utilities Commission	
Reporting Year:	2015	7/2014 - 6/2015
Data Validity Score:	90	

Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software: Grading Matrix

The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
WATER SUPPLIED											
Volume from own sources	Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)	Less than 25% of water production sources are metered, remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted	25% - 50% of treated water production sources are metered, other sources estimated. No regular meter accuracy testing or electronic calibration conducted.	Conditions between 2 and 4	50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing or electronic calibration conducted	Conditions between 4 and 6	At least 75% of treated water production sources are metered, <u>or</u> at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy	Conditions between 6 and 8	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowledgeable in the M36 methodology
Improvements to attain higher data grading for "Volume from own Sources" component:		<u>to qualify for 2:</u> Organize and launch efforts to collect data for determining volume from own sources	<u>to qualify for 4:</u> Locate all water production sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered water production sources and replace any obsolete/defective meters		<u>to qualify for 6:</u> Formalize annual meter accuracy testing for all source meters; specify the frequency of testing. Complete installation of meters on unmetered water production sources and complete replacement of all obsolete/defective meters		<u>to qualify for 8:</u> Conduct annual meter accuracy testing and calibration of related instrumentation on all meter installations on a regular basis. Complete project to install new, or replace defective existing, meters so that entire production meter population is metered. Repair or replace meters outside of +/- 6% accuracy		<u>to qualify for 10:</u> Maintain annual meter accuracy testing and calibration of related instrumentation for all meter installations. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to further improve meter accuracy		<u>to maintain 10:</u> Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology
Volume from own sources master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its sources of supply	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls. Flows are not balanced across the water distribution system: tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and archived flow data is adjusted only when grossly evident data error occurs	Conditions between 2 and 4	Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. "Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities. Meter data is adjusted when gross data errors occur, or occasional meter testing deems this necessary	Conditions between 4 and 6	Hourly production meter data logged automatically & reviewed on at least a weekly basis. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing. Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and data gaps in the archived data are corrected on at least a weekly basis	Conditions between 6 and 8	Continuous production meter data is logged automatically & reviewed each business day. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and data gaps in the archived data are corrected on a daily basis	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically balances flows from all sources and storages; results are reviewed each business day. Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected. Regular calibrations between SCADA and sources meters ensures minimal data transfer error
Improvements to attain higher data grading for "Master meter and supply error adjustment" component:		<u>to qualify for 2:</u> Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature	<u>to qualify for 4:</u> Install automatic datalogging equipment on production meters. Complete installation of level instrumentation at all tanks/storage facilities and include tank level data in automatic calculation routine in a computerized system. Construct a computerized listing or spreadsheet to archive input volumes, tank/storage volume changes and import/export flows in order to determine the composite "Water Supplied" volume for the distribution system. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps		<u>to qualify for 6:</u> Refine computerized data collection and archive to include hourly production meter data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Use daily net storage change to balance flows in calculating "Water Supplied" volume. Necessary corrections to data errors are implemented on a weekly basis.		<u>to qualify for 8:</u> Ensure that all flow data is collected and archived on at least an hourly basis. All data is reviewed and detected errors corrected each business day. Tank/storage levels variations are employed in calculating balanced "Water Supplied" component. Adjust production meter data for gross error and inaccuracy confirmed by testing		<u>to qualify for 10:</u> Link all production and tank/storage facility elevation change data to a Supervisory Control & Data Acquisition (SCADA) System, or similar computerized monitoring/control system, and establish automatic flow balancing algorithm and regularly calibrate between SCADA and source meters. Data is reviewed and corrected each business day		<u>to maintain 10:</u> Monitor meter innovations for development of more accurate and less expensive flowmeters. Continue to replace or repair meters as they perform outside of desired accuracy limits. Stay abreast of new and more accurate water level instruments to better record tank/storage levels and archive the variations in storage volume. Keep current with SCADA and data management systems to ensure that archived data is well-managed and error free
Water Imported:	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)	Less than 25% of imported water sources are metered, remaining sources are estimated. No regular meter accuracy testing	25% - 50% of imported water sources are metered; other sources estimated. No regular meter accuracy testing	Conditions between 2 and 4	50% - 75% of imported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted	Conditions between 4 and 6	At least 75% of imported water sources are metered, meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations. Less than 25% of tested meters are found outside of +/- 6% accuracy	Conditions between 6 and 8	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy
Improvements to attain higher data grading for "Water Imported Volume" component: *(Note: usually the water supplier selling the water - "the Exporter" - to the utility being audited is responsible to maintain the metering installation measuring the imported volume. The utility should coordinate carefully with the Exporter to ensure that adequate meter upkeep takes place and an accurate measure of the Water Imported volume is quantified.)*		<u>to qualify for 2:</u> Review bulk water purchase agreements with partner suppliers; confirm requirements for use and maintenance of accurate metering. Identify needs for new or replacement meters with goal to meter all imported water sources	<u>To qualify for 4:</u> Locate all imported water sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered imported water interconnections and replace obsolete/defective meters		<u>to qualify for 6:</u> Formalize annual meter accuracy testing for all imported water meters, planning for both regular meter accuracy testing and calibration of the related instrumentation. Continue installation of meters on unmetered imported water interconnections and replacement of obsolete/defective meters		<u>to qualify for 8:</u> Complete project to install new, or replace defective, meters on all imported water interconnections. Maintain annual meter accuracy testing for all imported water meters and conduct calibration of related instrumentation at least annually. Repair or replace meters outside of +/- 6% accuracy		<u>to qualify for 10:</u> Conduct meter accuracy testing for all meters on a semi-annual basis, along with calibration of all related instrumentation. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		<u>to maintain 10:</u> Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Continue to conduct calibration of related instrumentation on a semi-annual basis. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Water imported master meter and supply error adjustment	Select n/a if the Imported water supply is unmetered, with Imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility	Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition, data error cannot be determined Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing	No automatic datalogging of imported supply volumes, daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing	Conditions between 2 and 4	Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented Meter data is adjusted by the Exporter when gross data errors are detected A coherent data trail exists for this process to protect both the selling and the purchasing Utility Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management	Conditions between 4 and 6	Hourly Imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected, and to correct for error confirmed by meter accuracy testing Any data gaps in the archived data are detected and corrected during the weekly review A coherent data trail exists for this process to protect both the selling and the purchasing Utility	Conditions between 6 and 8	Continuous Imported supply metered flow data is logged automatically & reviewed each business day by the Exporter Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing Any data errors/gaps are detected and corrected on a daily basis A data trail exists for the process to protect both the selling and the purchasing Utility	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the Exporter Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling and purchasing Utility at least once every five years
Improvements to attain higher data grading for "Water imported master meter and supply error adjustment" component		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data, set a procedure to review flow data on a daily basis to detect input errors Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature Review the written agreement between the selling and purchasing Utility	to qualify for 4 Install automatic datalogging equipment on Imported supply meters Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps Launch discussions with the Exporters to jointly review terms of the written agreements regarding meter accuracy testing and data management, revise the terms as necessary		to qualify for 6 Refine computerized data collection and archive to include hourly Imported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps Make necessary corrections to errors/data errors on a weekly basis		to qualify for 8 Ensure that all Imported supply metered flow data is collected and archived on at least an hourly basis All data is reviewed and errors/data gaps are corrected each business day		to qualify for 10 Conduct accountability checks to confirm that all Imported supply metered data is reviewed and corrected each business day by the Exporter Results of all meter accuracy tests and data corrections should be available for sharing between the Exporter and the purchasing Utility Establish a schedule for a regular review and updating of the contractual language in the written agreement between the selling and the purchasing Utility, at least every five years		to maintain 10 Monitor meter innovations for development of more accurate and less expensive flowmeters, work with the Exporter to help identify meter replacement needs Keep communication lines with Exporters open and maintain productive relations Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties
Water Exported	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)	Less than 25% of exported water sources are metered, remaining sources are estimated No regular meter accuracy testing	25% - 50% of exported water sources are metered, other sources estimated No regular meter accuracy testing	Conditions between 2 and 4	50% - 75% of exported water sources are metered, other sources estimated Occasional meter accuracy testing conducted	Conditions between 4 and 6	At least 75% of exported water sources are metered, meter accuracy testing and/or electronic calibration conducted annually Less than 25% of tested meters are found outside of +/- 6% accuracy	Conditions between 6 and 8	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations with less than 10% of accuracy tests found outside of +/- 3% accuracy
Improvements to attain higher data grading for "Water Exported Volume" component *(Note usually, if the water utility being audited sells (Exports) water to a neighboring purchasing Utility it is the responsibility of the utility exporting the water to maintain the metering installation measuring the Exported volume The utility exporting the water should ensure that adequate meter upkeep takes place and an accurate measure of the Water Exported volume is quantified)*		to qualify for 2 Review bulk water sales agreements with purchasing utilities, confirm requirements for use & upkeep of accurate metering Identify needs to install new, or replace defective meters as needed	To qualify for 4 Locate all exported water sources on maps and in field, launch meter accuracy testing for existing meters, begin to install meters on unmetered exported water interconnections and replace obsolete/defective meters		to qualify for 6 Formalize annual meter accuracy testing for all exported water meters Continue installation of meters on unmetered exported water interconnections and replacement of obsolete/defective meters		to qualify for 8 Complete project to install new, or replace defective, meters on all exported water interconnections Maintain annual meter accuracy testing for all exported water meters Repair or replace meters outside of +/- 6% accuracy		to qualify for 10, Maintain annual meter accuracy testing for all meters Repair or replace meters outside of +/- 3% accuracy Investigate new meter technology, pilot one or more replacements with innovative meters in attempt to improve meter accuracy		to maintain 10 Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters Repair or replace meters outside of +/- 3% accuracy Continually investigate/pilot improving metering technology
Water exported master meter and supply error adjustment	Select n/a only if the water utility fails to have meters on its exported supply interconnections	Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition data error cannot be determined Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing	No automatic datalogging of exported supply volumes daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing	Conditions between 2 and 4	Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis, with necessary corrections implemented Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management	Conditions between 4 and 6	Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling the water Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected and to correct for error found by meter accuracy testing Any data gaps in the archived data are detected and corrected during the weekly review A coherent data trail exists for this process to protect both the selling (exporting) utility and the purchasing Utility	Conditions between 6 and 8	Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing Any data errors/gaps are detected and corrected on a daily basis A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Water exported master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data, set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the utility selling (exporting) the water and the purchasing Utility	to qualify for 4: Install automatic datalogging equipment on exported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the purchasing utilities to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary		to qualify for 6: Refine computerized data collection and archive to include hourly exported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis		to qualify for 8: Ensure that all exported metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day		to qualify for 10: Conduct accountability checks to confirm that all exported metered flow data is reviewed and corrected each business day by the utility selling the water. Results of all meter accuracy tests and data corrections should be available for sharing between the utility and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreements with the purchasing utilities, at least every five years		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters, work with the purchasing utilities to help identify meter replacement needs. Keep communication lines with the purchasing utilities open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties
AUTHORIZED CONSUMPTION											
Billed metered	n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero	Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population	At least 50% of customers with volume-based billing from meter reads; flat rate billing for others. Manual meter reading is conducted, with less than 50% meter read success rate, remanding accounts' consumption is estimated. Limited meter records, no regular meter testing or replacement. Billing data maintained on paper records, with no auditing	Conditions between 2 and 4	At least 75% of customers with volume-based, billing from meter reads; flat or fixed rate billing for remaining accounts. Manual meter reading is conducted with at least 50% meter read success rate, consumption for accounts with failed reads is estimated. Purchase records verify age of customer meters, only very limited meter accuracy testing is conducted. Customer meters are replaced only upon complete failure. Computerized billing records exist, but only sporadic internal auditing conducted	Conditions between 4 and 6	At least 90% of customers with volume-based billing from meter reads, consumption for remaining accounts is estimated. Manual customer meter reading gives at least 80% customer meter reading success rate, consumption for accounts with failed reads is estimated. Good customer meter records exist, but only limited meter accuracy testing is conducted. Regular replacement is conducted for the oldest meters. Computerized billing records exist with annual auditing of summary statistics conducting by utility personnel	Conditions between 6 and 8	At least 97% of customers exist with volume-based billing from meter reads. At least 90% customer meter reading success rate, or at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas. Good customer meter records. Regular meter accuracy testing guides replacement of statistically significant number of meters each year. Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years	Conditions between 8 and 10	At least 99% of customers exist with volume-based billing from meter reads. At least 95% customer meter reading success rate, or minimum 80% meter reading success rate, with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway. Statistically significant customer meter testing and replacement program in place on a continuous basis. Computerized billing with routine, detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years
Improvements to attain higher data grading for "Billed Metered Consumption" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures	to qualify for 4: Purchase and install meters on unmetered accounts. Implement policies to improve meter reading success. Catalog meter information during meter read visits to identify age/model of existing meters. Test a minimal number of meters for accuracy. Install computerized billing system		to qualify for 6: Purchase and install meters on unmetered accounts. Eliminate flat fee billing and establish appropriate water rate structure based upon measured consumption. Continue to achieve verifiable success in removing manual meter reading barriers. Expand meter accuracy testing. Launch regular meter replacement program. Launch a program of annual auditing of global billing statistics by utility personnel		to qualify for 8: Purchase and install meters on unmetered accounts. If customer meter reading success rate is less than 97%, assess cost-effectiveness of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system for portion or entire system, or otherwise achieve ongoing improvements in manual meter reading success rate to 97% or higher. Refine meter accuracy testing program. Set meter replacement goals based upon accuracy test results. Implement annual auditing of detailed billing records by utility personnel and implement third party auditing at least once every five years		to qualify for 10: Purchase and install meters on unmetered accounts. Launch Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system trials if manual meter reading success rate of at least 99% is not achieved within a five-year program. Continue meter accuracy testing program. Conduct planning and budgeting for large scale meter replacement based upon meter life cycle analysis using cumulative flow target. Continue annual detailed billing data auditing by utility personnel and conduct third party auditing at least once every three years		to maintain 10: Continue annual internal billing data auditing, and third party auditing at least every three years. Continue customer meter accuracy testing to ensure that accurate customer meter readings are obtained and entered as the basis for volume based billing. Stay abreast of improvements in Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) and information management. Plan and budget for justified upgrades in metering, meter reading and billing data management to maintain very high accuracy in customer metering and billing.
Billed unmetered	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter, i.e. no intentionally unmetered accounts exist	Water utility policy does not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach	Water utility policy does not require customer metering; flat or fixed fee billing is employed. Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods. Data from these sample meters are used to infer consumption for the total customer population. Site specific estimation methods are used for unusual buildings/water uses	Conditions between 2 and 4	Water utility policy does require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption; or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered. A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts	Conditions between 4 and 6	Water utility policy does require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings. As many as 15% of billed accounts are unmetered due to this exemption or meter installation difficulties. Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts	Conditions between 6 and 8	Water utility policy does require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances. The goal is to minimize the number of unmetered accounts. Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods	Conditions between 8 and 10	Water utility policy does require metering and volume based billing for all customer accounts. Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances. The goal exists to minimize the number of unmetered accounts to the extent that is economical. Reliable estimates of consumption are obtained at these accounts via site specific estimation methods

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Billed Unmetered Consumption" component		to qualify for 2 Conduct research and evaluate cost/benefit of a new water utility policy to require metering of the customer population, thereby greatly reducing or eliminating unmetered accounts Conduct pilot metering project by installing water meters in small sample of customer accounts and periodically reading the meters or datalogging the water consumption over one, three, or seven day periods	to qualify for 4 Implement a new water utility policy requiring customer metering Launch or expand pilot metering study to include several different meter types, which will provide data for economic assessment of full scale metering options Assess sites with access difficulties to devise means to obtain water consumption volumes Begin customer meter installation		to qualify for 6 Refine policy and procedures to improve customer metering participation for all but solidly exempt accounts Assign staff resources to review billing records to identify errant unmetered properties Specify metering needs and funding requirements to install sufficient meters to significant reduce the number of unmetered accounts		to qualify for 8 Push to install customer meters on a full scale basis Refine metering policy and procedures to ensure that all accounts, including municipal properties, are designated for meters Plan special efforts to address "hard-to-access" accounts Implement procedures to obtain a reliable consumption estimate for the remaining few unmetered accounts awaiting meter installation		to qualify for 10 Continue customer meter installation throughout the service area, with a goal to minimize unmetered accounts Sustain the effort to investigate accounts with access difficulties, and devise means to install water meters or otherwise measure water consumption		to maintain 10 Continue to refine estimation methods for unmetered consumption and explore means to establish metering, for as many billed remaining unmetered accounts as is economically feasible
Unbilled metered	select n/a if all billing-exempt consumption is unmetered	Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist, and a reliable count of unbilled metered accounts is unavailable Meter upkeep and meter reading on these accounts is rare and not considered a priority Due to poor recordkeeping and lack of auditing, water consumption for all such accounts is purely guesstimated	Billing practices exempt certain accounts such as municipal buildings, but only scattered, dated written directives exist to justify this practice A reliable count of unbilled metered accounts is unavailable Sporadic meter replacement and meter reading occurs on an as-needed basis The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size	Conditions between 2 and 4	Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts Meter reading is given low priority and is sporadic Consumption is quantified from meter readings where available The total number of unbilled, unmetered accounts must be estimated along with consumption volumes	Conditions between 4 and 6	Written policies regarding billing exemptions exist but adherence in practice is questionable Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts Periodic auditing of such accounts is conducted Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated	Conditions between 6 and 8	Written policy identifies the types of accounts granted a billing exemption Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit High level auditing of billing records ensures that a reliable census of such accounts exists	Conditions between 8 and 10	Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted Regular auditing confirms this Total water consumption for these accounts is taken from reliable readings from accurate meters
Improvements to attain higher data grading for "Unbilled Metered Consumption" component		to qualify for 2 Reassess the water utility's policy allowing certain accounts to be granted a billing exemption Draft an outline of a new written policy for billing exemptions, with clear justification as to why any accounts should be exempt from billing, and with the intention to keep the number of such accounts to a minimum	to qualify for 4 Review historic written directives and policy documents allowing certain accounts to be billing-exempt Draft an outline of a written policy for billing exemptions, identify criteria that grants an exemption, with a goal of keeping this number of accounts to a minimum Consider increasing the priority of reading meters on unbilled accounts at least annually		to qualify for 6 Draft a new written policy regarding billing exemptions based upon consensus criteria allowing this occurrence Assign resources to audit meter records and billing records to obtain census of unbilled metered accounts Gradually include a greater number of these metered accounts to the routes for regular meter reading		to qualify for 8 Communicate billing exemption policy throughout the organization and implement procedures that ensure proper account management Conduct inspections of accounts confirmed in unbilled metered status and verify that accurate meters exist and are scheduled for routine meter readings Gradually increase the number of unbilled metered accounts that are included in regular meter reading routes		to qualify for 10 Ensure that meter management (meter accuracy testing, meter replacement) and meter reading activities for unbilled accounts are accorded the same priority as billed accounts Establish ongoing annual auditing process to ensure that water consumption is reliably collected and provided to the annual water audit process		to maintain 10 Reassess the utility's philosophy in allowing any water uses to go "unbilled" It is possible to meter and bill all accounts, even if the fee charged for water consumption is discounted or waived Metering and billing all accounts ensures that water consumption is tracked and water waste from plumbing leaks is detected and minimized
Unbilled unmetered		Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping Total consumption is quantified based upon a purely subjective estimate	Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption, but without sufficient documentation to quantify an accurate estimate of the annual volume consumed	Conditions between 2 and 4	Extent of unbilled, unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events)	Default value of 1 25% of system input volume is employed	Coherent policies exist for some forms of unbilled, unmetered consumption but others await closer evaluation Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference but unsupervised uses are guesstimated	Conditions between 6 and 8	Clear policies and good recordkeeping exist for some uses (ex water used in periodic testing of unmetered fire connections) but other uses (ex miscellaneous uses of fire hydrants) have limited oversight Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow, multiplied by number of events) or temporary meters, and relatively subjective estimates of less regulated use	Conditions between 8 and 10	Clear policies exist to identify permitted use of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow multiplied by number of events) or use of temporary meters
Improvements to attain higher data grading for "Unbilled Unmetered Consumption" component		to qualify for 5 Utilize the accepted default value of 1 25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use to qualify for 2 Establish a policy regarding what water uses should be allowed to remain as unbilled and unmetered Consider tracking a small sample of one such use (ex fire hydrant flushings)	to qualify for 5 Utilize accepted default value of 1 25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use to qualify for 4 Evaluate the documentation of events that have been observed Meet with user groups (ex for fire hydrants - fire departments, contractors to ascertain their need and/or volume requirements for water from fire hydrants)		to qualify for 5 Utilize accepted default value of 1 25% of the volume of water supplied as an expedient means to gain a reasonable quantification of all such use This is particularly appropriate for water utilities who are in the early stages of the water auditing process and should focus on other components since the volume of unbilled umetered consumption is usually a relatively small quatity component, and other larger-quantity components should take priority	to qualify for 8 or greater Finalize policy and begin to conduct field checks to better establish and quantify such usage Proceed if top-down audit exists and/or a great volume of such use is suspected	to qualify for 8 Assess water utility policy and procedures for various unmetered usages For example ensure that a policy exists and permits are issued for use of fire hydrants by persons outside of the utility Create written procedures for use and documentation of fire hydrants by water utility personnel Use same approach for other types of unbilled unmetered water usage		to qualify for 10 Refine written procedures to ensure that all uses of unbilled unmetered water are overseen by a structured permitting process managed by water utility personnel Reassess policy to determine if some of these uses have value in being converted to billed and/or metered status		to maintain 10 Continue to refine policy and procedures with intention of reducing the number of allowable uses of water in unbilled and unmetered fashion Any uses that can feasibly become billed and metered should be converted eventually

APPARENT LOSSES

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Unauthorized consumption:		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping. Total unauthorized consumption is guesstimated	Unauthorized consumption is a known occurrence, but its extent is a mystery. There are no requirements to document observed events, but periodic field reports capture some of these occurrences. Total unauthorized consumption is approximated from this limited data.	conditions between 2 and 4	Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings. Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events)	Default value of 0.25% of volume of water supplied is employed	Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation. Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy. Volumes quantified by inference from these records	Conditions between 6 and 8	Clear policies and good auditable recordkeeping exist for certain events (ex: tampering with water meters, illegal bypasses of customer meters), but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption	Conditions between 8 and 10	Clear policies exist to identify all known unauthorized uses of water. Staff and procedures exist to provide enforcement of policies and detect violations. Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods. All records and calculations should exist in a form that can be audited by a third party
Improvements to attain higher data grading for "Unauthorized Consumption" component:		<u>to qualify for 5</u>: Use accepted default of 0.25% of volume of water supplied <u>to qualify for 2</u>: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)	<u>to qualify for 5</u>: Use accepted default of 0.25% of system input volume <u>to qualify for 4</u>: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)		<u>to qualify for 5</u>: Utilize accepted default value of 0.25% of volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process	<u>to qualify for 6 or greater</u>: Finalize policy updates to clearly identify the types of water consumption that are authorized from those usages that fall outside of this policy and are, therefore, unauthorized. Begin to conduct regular field checks. Proceed if the top-down audit already exists and/or a great volume of such use is suspected	<u>to qualify for 8</u>: Assess water utility policies to ensure that all known occurrences of unauthorized consumption are outlawed, and that appropriate penalties are prescribed. Create written procedures for detection and documentation of various occurrences of unauthorized consumption as they are uncovered		<u>to qualify for 10</u>: Refine written procedures and assign staff to seek out likely occurrences of unauthorized consumption. Explore new locking devices, monitors and other technologies designed to detect and thwart unauthorized consumption		<u>to maintain 10</u>: Continue to refine policy and procedures to eliminate any loopholes that allow or tacitly encourage unauthorized consumption. Continue to be vigilant in detection, documentation and enforcement efforts
Customer metering inaccuracies:	select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero	Customer meters exist, but with unorganized paper records on meters, no meter accuracy testing or meter replacement program for any size of retail meter. Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated	Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing. Existing paper records gathered and organized to provide cursory disposition of meter population. Customer meters are tested for accuracy only upon customer request	Conditions between 2 and 4	Reliable recordkeeping exists, meter information is improving as meters are replaced. Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory). A limited number of the oldest meters are replaced each year. Inaccuracy volume is largely an estimate, but refined based upon limited testing data	Conditions between 4 and 6	A reliable electronic recordkeeping system for meters exists. The meter population includes a mix of new high performing meters and dated meters with suspect accuracy. Routine, but limited, meter accuracy testing and meter replacement occur. Inaccuracy volume is quantified using a mix of reliable and less certain data	Conditions between 6 and 8	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Statistically significant number of meters are tested in audit year. This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters	Good records of all active customer meters exist and include as a minimum: meter number, account number/location, type, size and manufacturer. Ongoing meter replacement occurs according to a targeted and justified basis. Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population. New metering technology is embraced to keep overall accuracy improving. Procedures are reviewed by a third party knowledgeable in the M36 methodology
Improvements to attain higher data grading for "Customer meter inaccuracy volume" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes	<u>to qualify for 2</u>: Gather available meter purchase records. Conduct testing on a small number of meters believed to be the most inaccurate. Review staffing needs of the metering group and budget for necessary resources to better organize meter management	<u>to qualify for 4</u>: Implement a reliable record keeping system for customer meter histories, preferably using electronic methods typically linked to, or part of, the Customer Billing System or Customer Information System. Expand meter accuracy testing to a larger group of meters		<u>to qualify for 6</u>: Standardize the procedures for meter recordkeeping within an electronic information system. Accelerate meter accuracy testing and meter replacements guided by testing results		<u>to qualify for 8</u>: Expand annual meter accuracy testing to evaluate a statistically significant number of meter makes/models. Expand meter replacement program to replace statistically significant number of poor performing meters each year		<u>to qualify for 9</u>: Continue efforts to manage meter population with reliable recordkeeping. Test a statistically significant number of meters each year and analyze test results in an ongoing manner to serve as a basis for a target meter replacement strategy based upon accumulated volume throughput	<u>to qualify for 10</u>: Continue efforts to manage meter population with reliable recordkeeping, meter testing and replacement. Evaluate new meter types and install one or more types in 5-10 customer accounts each year in order to pilot improving metering technology	<u>to maintain 10</u>: Increase the number of meters tested and replaced as justified by meter accuracy test data. Continually monitor development of new metering technology and Advanced Metering Infrastructure (AMI) to grasp opportunities for greater accuracy in metering of water flow and management of customer consumption data

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Systematic Data Handling Errors	Note: all water utilities incur some amount of this error. Even in water utilities with unmetered customer populations and fixed rate billing, errors occur in annual billing tabulations. Enter a positive value for the volume and select a grading	Policies and procedures for activation of new customer water billing accounts are vague and lack accountability. Billing data is maintained on paper records which are not well organized. No auditing is conducted to confirm billing data handling efficiency. An unknown number of customers escape routine billing due to lack of billing process oversight	Policy and procedures for activation of new customer accounts and oversight of billing records exist but need refinement. Billing data is maintained on paper records or insufficiently capable electronic database. Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency. The volume of unbilled water due to billing lapses is a guess	Conditions between 2 and 4	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement. Computerized billing system exists, but is dated or lacks needed functionality. Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses	Conditions between 4 and 6	Policy and procedures for new account activation and oversight of billing operations is adequate and reviewed periodically. Computerized billing system is in use with basic reporting available. Any affect of billing adjustments on measured consumption volumes is well understood. Internal checks of billing data error conducted annually. Reasonably accurate quantification of consumption volume lost to billing lapses is obtained	Conditions between 6 and 8	New account activation and billing operations policy and procedures are reviewed at least biannually. Computerized billing system includes an array of reports to confirm billing data and system functionality. Checks are conducted routinely to flag and explain zero consumption accounts. Annual internal checks conducted with third party audit conducted at least once every five years. Accountability checks flag billing lapses. Consumption lost to billing lapses is well quantified and reducing year-by-year	Conditions between 8 and 10	Sound written policy and procedures exist for new account activation and oversight of customer billing operations. Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle. Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs
Improvements to attain higher data grading for "Systematic Data Handling Error volume" component		to qualify for 2 Draft written policy and procedures for activating new water billing accounts and oversight of billing operations. Investigate and budget for computerized customer billing system. Conduct initial audit of billing records by flow-charting the basic business processes of the customer account/billing function	to qualify for 4 Finalize written policy and procedures for activation of new billing accounts and overall billing operations management. Implement a computerized customer billing system. Conduct initial audit of billing records as part of the process		to qualify for 6 Refine new account activation and billing operations procedures and ensure consistency with the utility policy regarding billing, and minimize opportunity for missed billings. Upgrade or replace customer billing system for needed functionality - ensure that billing adjustments don't corrupt the value of consumption volumes. Procedurize internal annual audit process		to qualify for 8 Formalize regular review of new account activation process and general billing practices. Enhance reporting capability of computerized billing system. Formalize regular auditing process to reveal scope of data handling error. Plan for periodic third party audit to occur at least once every five years		to qualify for 10 Close policy/procedure loopholes that allow some customer accounts to go unbilled, or data handling errors to exist. Ensure that billing system reports are utilized, analyzed and reported every billing cycle. Ensure that internal and third party audits are conducted at least once every three years		to maintain 10 Stay abreast of customer information management developments and innovations. Monitor developments of Advanced Metering Infrastructure (AMI) and integrate technology to ensure that customer endpoint information is well-monitored and errors/lapses are at an economic minimum
SYSTEM DATA											
Length of mains		Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments). Poor procedures to ensure that new water mains installed by developers are accurately documented	Conditions between 2 and 4	Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length	Conditions between 4 and 6	Sound written policy and procedures exist for permitting and commissioning new water mains. Highly accurate paper records with regular field validation, or electronic records and asset management system in good condition. Includes system backup	Conditions between 6 and 8	Sound written policy and procedures exist for permitting and commissioning new water mains. Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data	Conditions between 8 and 10	Sound written policy exists for managing water mains extensions and replacements. Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases. Records of annual field validation should be available for review
Improvements to attain higher data grading for "Length of Water Mains" component		to qualify for 2 Assign personnel to inventory current as-built records and compare with customer billing system records and highway plans in order to verify poorly documented pipelines. Assemble policy documents regarding permitting and documentation of water main installations by the utility and building developers, identify gaps in procedures that result in poor documentation of new water main installations	to qualify for 4 Complete inventory of paper records of water main installations for several years prior to audit year. Review policy and procedures for commissioning and documenting new water main installation		to qualify for 6 Finalize updates/improvements to written policy and procedures for permitting/commissioning new main installations. Confirm inventory of records for five years prior to audit year; correct any errors or omissions		to qualify for 8 Launch random field checks of limited number of locations. Convert to electronic database such as a Geographic Information System (GIS) with backup as justified. Develop written policy and procedures		to qualify for 10 Link Geographic Information System (GIS) and asset management databases, conduct field verification of data. Record field verification information at least annually		to maintain 10 Continue with standardization and random field validation to improve the completeness and accuracy of the system
Number of active AND inactive service connections		Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections, which may be 10-15% in error from actual count	General permitting policy exists but paper records, procedural gaps, and weak oversight result in questionable total for number of connections, which may vary 5-10% of actual count	Conditions between 2 and 4	Written account activation policy and procedures exist, but with some gaps in performance and oversight. Computerized information management system is being brought online to replace dated paper recordkeeping system. Reasonably accurate tracking of service connection installations & abandonments but count can be up to 5% in error from actual total	Conditions between 4 and 8	Written new account activation and overall billing policies and procedures are adequate and reviewed periodically. Computerized information management system is in use with annual installations & abandonments totaled. Very limited field verifications and audits. Error in count of number of service connections is believed to be no more than 3%	Conditions between 8 and 8	Policies and procedures for new account activation and overall billing operations are written, well-structured and reviewed at least biannually. Well-managed computerized information management system exists and routine, periodic field checks and internal system audits are conducted. Counts of connections are no more than 2% in error	Conditions between 8 and 10	Sound written policy and well managed and audited procedures ensure reliable management of service connection population. Computerized information management system, Customer Billing System, and Geographic Information System (GIS) information agree, field validation proves truth of databases. Count of connections recorded as being in error is less than 1% of the entire population
Improvements to attain higher data grading for "Number of Active and Inactive Service Connections" component	**Note: The number of Service Connections does <u>not</u> include fire hydrant leads/lines connecting the hydrant to the water main**	to qualify for 2 Draft new policy and procedures for new account activation and overall billing operations. Research and collect paper records of installations & abandonments for several years prior to audit year	to qualify for 4 Refine policy and procedures for new account activation and overall billing operations. Research computerized recordkeeping system (Customer Information System or Customer Billing System) to improve documentation format for service connections		to qualify for 6 Refine procedures to ensure consistency with new account activation and overall billing policy to establish new service connections or decommission existing connections. Improve process to include all totals for at least five years prior to audit year		to qualify for 8 Formalize regular review of new account activation and overall billing operations policies and procedures. Launch random field checks of limited number of locations. Develop reports and auditing mechanisms for computerized information management system		to qualify for 10 Close any procedural loopholes that allow installations to go undocumented. Link computerized information management system with Geographic Information System (GIS) and formalize field inspection and information system auditing processes. Documentation of new or decommissioned service connections encounters several levels of checks and balances		to maintain 10 Continue with standardization and random field validation to improve knowledge of system
	Note: if customer water	Gradings 1-9 apply if customer properties are unmetered, if customer meters exist and are located inside the customer building premises, or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building. In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping, and the typical first point of use (ex: faucet) or the customer meter must be quantified. Gradings of 1-9 are used to grade the validity of the means to quantify this value. (See the "Service Connection Diagram" worksheet)									Either of two conditions can be met for a grading of 10

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Average length of customer service line	meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility, then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under the Grading of 10(a) will be followed, with a value of zero automatically entered at a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance	Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping. Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating this distance is arbitrary due to the unknown location of many curb stops	Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. The piping from the water main to the curb stop is the property of the water utility, and the piping from the curb stop to the customer building is owned by the customer. Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field	Conditions between 2 and 4	Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy	Conditions between 4 and 6	Clear written policy exists to define utility/customer responsibility for service connection piping. Accurate, well-maintained paper or basic electronic recordkeeping system exists. Periodic field checks confirm piping lengths for a sample of customer properties	Conditions between 6 and 8	Clearly worded policy standardizes the location of curb stops and meters, which are inspected upon installation. Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meter pits. An accurate number of customer properties from the customer billing system allows for reliable averaging of this length	Conditions between 8 and 10	a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Working asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet. b) Meters exist inside customer buildings, or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:		to qualify for 2 Research and collect paper records of service line installations. Inspect several sites in the field using pipe locators to locate curb stops. Obtain the length of this small sample of connections in this manner	to qualify for 4 Formalize and communicate policy delineating utility/customer responsibilities for service connection piping. Assess accuracy of paper records by field inspection of a small sample of service connections using pipe locators as needed. Research the potential migration to a computerized information management system to store service connection data		to qualify for 6 Establish coherent procedures to ensure that policy for curb stop, meter installation and documentation is followed. Gain consensus within the water utility for the establishment of a computerized information management system		to qualify for 8 Implement an electronic means of recordkeeping, typically via a customer information system, customer billing system, or Geographic Information System (GIS). Standardize the process to conduct field checks of a limited number of locations		to qualify for 10 Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data		to maintain 10 Continue with standardization and random field validation to improve knowledge of service connection configurations and customer meter locations
Average operating pressure		Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions. Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps. Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation.	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks. Pressure data is gathered at individual sites only when low pressure complaints arise. Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system	Conditions between 2 and 4	Effective pressure controls separate different pressure zones, moderate pressure variation across the system, occasional open boundary valves are discovered that breech pressure zones. Basic telemetry monitoring of the distribution system logs pressure data electronically. Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing. Reliable topographical data exists. Average pressure is calculated using this mix of data	Conditions between 4 and 6	Reliable pressure controls separate distinct pressure zones, only very occasional open boundary valves are encountered that breech pressure zones. Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically. Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing. Average pressure is determined by using this mix of reliable data	Conditions between 6 and 8	Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations. A current full-scale SCADA System or similar realtime monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system. The average system pressure is determined from reliable monitoring system data	Conditions between 8 and 10	Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system. Average system pressure is reliably calculated from extensive, reliable, and cross-checked data. Calculations are reported on an annual basis as a minimum
Improvements to attain higher data grading for "Average Operating Pressure" component:		to qualify for 2 Employ pressure gauging and/or datalogging equipment to obtain pressure measurements from fire hydrants. Locate accurate topographical maps of service area in order to confirm ground elevations. Research pump data sheets to find pump pressure/flow characteristics	to qualify for 4 Formalize a procedure to use pressure gauging/datalogging equipment to gather pressure data during various system events such as low pressure complaints, or operational testing. Gather pump pressure and flow data at different flow regimes. Identify faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) and plan to properly configure pressure zones. Make all pressure data from these efforts available to generate system-wide average pressure		to qualify for 6 Expand the use of pressure gauging/datalogging equipment to gather scattered pressure data at a representative set of sites, based upon pressure zones or areas. Utilize pump pressure and flow data to determine supply head entering each pressure zone or district. Correct any faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) to ensure properly configured pressure zones. Use expanded pressure dataset from these activities to generate system-wide average pressure		to qualify for 8 Install a Supervisory Control and Data Acquisition (SCADA) System, or similar realtime monitoring system, to monitor system parameters and control operations. Set regular calibration schedule for instrumentation to insure data accuracy. Obtain accurate topographical data and utilize pressure data gathered from field surveys to provide extensive, reliable data for pressure averaging		to qualify for 10 Annually, obtain a system-wide average pressure value from the hydraulic model of the distribution system that has been calibrated via field measurements in the water distribution system and confirmed in comparisons with SCADA System data		to maintain 10 Continue to refine the hydraulic model of the distribution system and consider linking it with SCADA System for real-time pressure data calibration, and averaging

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
COST DATA											
Total annual cost of operating water system		Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to estimate the major portion of water system operating costs	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place However, gaps in data are known to exist, periodic internal reviews are conducted but not a structured financial audit	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA)	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked Data audited at least annually by utility personnel, and at least once every three years by third-party CPA	Conditions between 8 and 10	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked Data audited annually by utility personnel and annually also by third-party CPA
Improvements to attain higher data grading for "Total Annual Cost of Operating the Water System" component		<u>to qualify for 2</u> Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions	<u>to qualify for 4</u> Implement an electronic cost accounting system, structured according to accounting standards for water utilities		<u>to qualify for 6</u> Establish process for periodic internal audit of water system operating costs, identify cost data gaps and institute procedures for tracking these outstanding costs		<u>to qualify for 8</u>: Standardize the process to conduct routine financial audit on an annual basis Arrange for CPA audit of financial records at least once every three years		<u>to qualify for 10</u> Standardize the process to conduct a third-party financial audit by a CPA on an annual basis		<u>to maintain 10</u> Maintain program stay abreast of expenses subject to erratic cost changes and long-term cost trend, and budget/track costs proactively
Customer retail unit cost (applied to Apparent Losses)	Customer population unmetered, and/or only a fixed fee is charged for consumption	Antiquated, cumbersome water rate structure is used, with periodic historic amendments that were poorly documented and implemented, resulting in classes of customers being billed inconsistent charges The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate	Dated, cumbersome water rate structure, not always employed consistently in actual billing operations The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified	Conditions between 2 and 4	Straight-forward water rate structure in use, but not updated in several years Billing operations reliably employ the rate structure The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the effect of different rates from varying customer classes	Conditions between 4 and 6	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block	Conditions between 6 and 8	Effective water rate structure is in force and is applied reliably in billing operations Composite customer rate is determined using a weighted average composite consumption rate, which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure	Conditions between 8 and 10	Current, effective water rate structure is in force and applied reliably in billing operations The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every five years
Improvements to attain higher data grading for "Customer Retail Unit Cost" component		<u>to qualify for 2</u> Formalize the process to implement water rates including a secure documentation procedure Create a current, formal water rate document and gain approval from all stakeholders	<u>to qualify for 4</u> Review the water rate structure and update/formalize as needed Assess billing operations to ensure that actual billing operations incorporate the established water rate structure		<u>to qualify for 6</u> Evaluate volume of water used in each usage block by residential users Multiply volumes by full rate structure	<u>Launch effort to fully meter the customer population and charge rates based upon water volumes</u>	<u>to qualify for 8</u> Evaluate volume of water used in each usage block by all classifications of users Multiply volumes by full rate structure		<u>to qualify for 10</u> Conduct a periodic third-party audit of water used in each usage block by all classifications of users Multiply volumes by full rate structure		<u>to maintain 10</u> Keep water rate structure current in addressing the water utility's revenue needs Update the calculation of the customer unit rate as new rate components, customer classes, or other components are modified
Variable production cost (applied to Real Losses).	Note if the water utility purchases/imports its entire water supply then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10	Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable) All costs are audited internally on a periodic basis	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply, are included in the unit variable production cost as applicable The data is audited at least annually by utility personnel	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked The data is audited at least annually by utility personnel and at least once every three years by a third-party knowledgeable in the M36 methodology	Conditions between 8 and 10	Either of two conditions can be met to obtain a grading of 10 1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis or 2) Water supply is entirely purchased as bulk water imported and the unit purchase cost - including <u>all</u> applicable marginal supply costs - serves as the variable production cost If <u>all</u> applicable marginal supply costs are not included in the figure a grade of 10 should <u>not</u> be selected
Improvements to attain higher data grading for "Variable Production Cost" component		<u>to qualify for 2</u> Gather available records institute new procedures to regularly collect and audit basic cost data and most important operations functions	<u>to qualify for 4</u> Implement an electronic cost accounting system structured according to accounting standards for water utilities		<u>to qualify for 6</u> Formalize process for regular internal audits of production costs Assess whether additional costs (liability, residuals management equipment wear impending infrastructure expansion) should be included to calculate a more representative variable production cost		<u>to qualify for 8</u> Formalize the accounting process to include direct cost components (power treatment) as well as indirect cost components (liability, residuals management etc) Arrange to conduct audits by a knowledgable third-party at least once every three years		<u>to qualify for 10</u> Standardize the process to conduct a third-party financial audit by a CPA on an annual basis		<u>to maintain 10</u> Maintain program stay abreast of expenses subject to erratic cost changes and budget/track costs proactively

Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, Lp, for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration Lp = 0 since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where Lp is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building , where Lp is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the Lp will vary notably in a community of different structures, therefore the average Lp value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

Click for more information

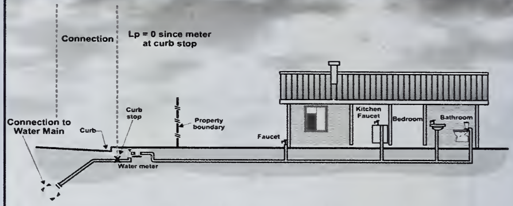


Figure 1

Typical house connection: Meter at curb stop
Not to scale

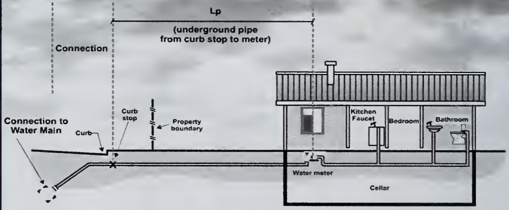


Figure 2

Typical house connection: Meter inside property
Not to scale

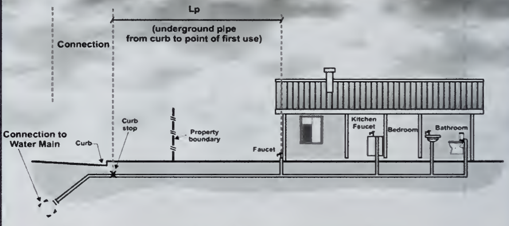


Figure 3

Typical house connection: Unmetered
Not to scale

Item Name	Description
Apparent Losses Find	= unauthorized consumption + customer metering inaccuracies + systematic data handling errors Apparent Losses include all types of inaccuracies associated with customer metering (worn meters as well as improperly sized meters or wrong type of meter for the water usage profile) as well as systematic data handling errors (meter reading, billing, archiving and reporting), plus unauthorized consumption (theft or illegal use). NOTE: Over-estimation of Apparent Losses results in under-estimation of Real Losses. Under-estimation of Apparent Losses results in over-estimation of Real Losses.
AUTHORIZED CONSUMPTION Find	= billed water exported + billed metered + billed unmetered + unbilled metered + unbilled unmetered consumption The volume of metered and/or unmetered water taken by registered customers, the water utility's own uses, and uses of others who are implicitly or explicitly authorized to do so by the water utility; for residential, commercial, industrial and public-minded purposes. Typical retail customers' consumption is tabulated usually from established customer accounts as billed metered consumption, or - for unmetered customers - billed unmetered consumption. These types of consumption, along with billed water exported, provide revenue potential for the water utility **Be certain to tabulate the water exported volume as a separate component and do not "double-count" it by including in the billed metered consumption component as well as the water exported component.** Unbilled authorized consumption occurs typically in non-account uses, including water for fire fighting and training, flushing of water mains and sewers, street cleaning, watering of municipal gardens, public fountains, or similar public-minded uses. Occasionally these uses may be metered and billed (or charged a flat fee), but usually they are unmetered and unbilled. In the latter case, the water auditor may use a default value to estimate this quantity, or implement procedures for the reliable quantification of these uses. This starts with documenting usage events as they occur and estimating the amount of water used in each event (See Unbilled unmetered consumption)
View Service Connection Diagram Average length of customer service line Find	This is the average length of customer service line, Lp, that is owned and maintained by the customer; from the point of ownership transfer to the customer water meter, or building line (if unmetered). The quantity is one of the data inputs for the calculation of Unavoidable Annual Real Losses (UARL), which serves as the denominator of the performance indicator: Infrastructure Leakage Index (ILI). The value of Lp is multiplied by the number of customer service connections to obtain a total length of customer owned piping in the system. The purpose of this parameter is to account for the unmetered service line infrastructure that is the responsibility of the customer for arranging repairs of leaks that occur on their lines. In many cases leak repairs arranged by customers take longer to be executed than leak repairs arranged by the water utility on utility-maintained piping. Leaks run longer - and lose more water - on customer-owned service piping than utility owned piping. If the customer water meter exists near the ownership transfer point (usually the curb stop located between the water main and the customer premises) this distance is zero because the meter and transfer point are the same. This is the often encountered configuration of customer water meters located in an underground meter box or "pit" outside of the customer's building. The Free Water Audit Software asks a "Yes/No" question about the meter at this location If the auditor selects "Yes" then this distance is set to zero and the data grading score for this component is set to 10. If water meters are typically located inside the customer premise/building, or properties are unmetered, it is up to the water auditor to estimate a system-wide average Lp length based upon the various customer land parcel sizes and building locations in the service area Lp will be a shorter length in areas of high density housing, and a longer length in areas of low density housing and varied commercial and industrial buildings. General parcel demographics should be employed to obtain a composite average Lp length for the entire system. Refer to the "Service Connection Diagram" worksheet for a depiction of the service line/metering configurations that typically exist in water utilities This worksheet gives guidance on the determination of the Average Length, Lp, for each configuration.
Average operating pressure Find	This is the average pressure in the distribution system that is the subject of the water audit. Many water utilities have a calibrated hydraulic model of their water distribution system. For these utilities, the hydraulic model can be utilized to obtain a very accurate quantity of average pressure. In the absence of a hydraulic model, the average pressure may be approximated by obtaining readings of static water pressure from a representative sample of fire hydrants or other system access points evenly located across the system. A weighted average of the pressure can be assembled; but be sure to take into account the elevation of the fire hydrants, which typically exist several feet higher than the level of buried water pipelines. If the water utility is compiling the water audit for the first time, the average pressure can be approximated, but with a low data grading. In subsequent years of auditing, effort should be made to improve the accuracy of the average pressure quantity. This will then qualify the value for a higher data grading.
Billed Authorized Consumption	All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Billed metered consumption Find	All metered consumption which is billed to retail customers, including all groups of customers such as domestic, commercial, industrial or institutional **It does NOT include water supplied to neighboring utilities (water exported) which is metered and billed. Be sure to subtract any consumption for exported water sales that may be included in these billing roles. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.** The metered consumption data can be taken directly from billing records for the water audit period The accuracy of yearly metered consumption data can be refined by including an adjustment to account for customer meter reading lag time since not all customer meters are read on the same day of the meter reading period. However additional analysis is necessary to determine the lag time adjustment value, which may or may not be significant
Billed unmetered consumption Find	All billed consumption which is calculated based on estimates or norms from water usage sites that have been determined by utility policy to be left unmetered This is typically a very small component in systems that maintain a policy to meter their customer population. However, this quantity can be the key consumption component in utilities that have not adopted a universal metering policy. **This component should NOT include any water that is supplied to neighboring utilities (water exported) which is unmetered but billed. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.**

Item Name	Description
Customer metering inaccuracies Find	Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear c from the improper application of the meter; i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger. The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for <u>all</u> customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testir activities, he or she can calculate their own loss volumes, and this volume may be entered directly. Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degre of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.
Customer retail unit cost Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, sto water or biosolids processing, <u>but only if</u> these charges are based upon the volume of potable water consumed. For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer. Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet, or $/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, $.
Infrastructure Leakage Index (ILI) Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.
Length of mains Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as: Length of Mains, miles = (total pipeline length, miles) + [{(average fire hydrant lead length, ft) x (number of fire hydrants)} / 5,280 ft/mile] or Length of Mains, kilometres = (total pipeline length, kilometres) + [{(average fire hydrant lead length, metres) x (number of fire hydrants)} / 1,000 metres/kilometre]
NON-REVENUE WATER Find	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potenti to the utility.
Number of <u>active AND inactive</u> service connections Find	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). **Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hyrants should be include in the "Length of mains" parameter.**
Real Losses Find	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property Th annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density Find	=number of customer service connections / length of mains

Item Name	Description
Systematic data handling errors Find	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts, and any type of data lapse that results in under-stated customer water consumption in summary billing reports. **Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.** Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. <u>Data Transfer Errors</u> result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors Apparent losses also occur from <u>Data Analysis Errors</u> in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor <u>has</u> investigated the billing system and its controls, and <u>has</u> well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. <u>Note</u> negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water
Unauthorized consumption Find	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system. Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL) Find	UARL (gallons)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on determing the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, <u>in gallons:</u> (Lm x 32) + Nc < 3000 or P <35psi <u>in litres:</u> (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true

Item Name	Description
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.
Unbilled metered consumption Find	Metered consumption which is authorized by the water utility, but, for any reason, is deemed by utility policy to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does not include water supplied to neighboring utilities (water exported) which may be metered but not billed.**
Unbilled unmetered consumption Find	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility has carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: 1 — Convert From... **Million Gallons (US)** = **Converts to.....** **3.06888329** **Acre-feet** (conversion factor = 3.06888328973723)
Use of Option Buttons	To use the default percent value choose this button To enter a value choose this button and enter the value in the cell to the right Pcnt: 1.25% — Value **NOTE:** For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item, a grading value of 5 is automatically applied (however, this grade will not be displayed).
Variable production cost (applied to Real Losses) Find	The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources Find	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.

Item Name	Description
plume from own ources: Master eter and supply rror adjustment Find	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should <u>not</u> be entered. Enter a negative percentage or value for metered data under-registration, or enter a positive percentage or value for metered data over-registration.
Nater exported Find	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**
Vater exported: aster meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should <u>not</u> be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Nater imported Find	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Vater imported: aster meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should <u>not</u> be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
VATER LOSSES Find	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

AWWA Free Water Audit Software: Determining Water Loss Standing

WAS v5.0

Water Audit Report for:	San Francisco Public Utilities Commission	
Reporting Year:	2015	7/2014 - 6/2015
Data Validity Score:	90	

Water Loss Control Planning Guide

	Water Audit Data Validity Level / Score				
Functional Focus Area	**Level I** (0-25)	**Level II** (26-50)	**Level III** (51-70)	**Level IV** (71-90)	**Level V** (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs. Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or Automatic Meter Reading (AMR) system.	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.

Once data have been entered into the Reporting Worksheet, the performance indicators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

Example 1a: Million Gallons: | Example 1b: Million Gallons: Performance Indicators | Example 2a: Megalitres: Reporting Worksheet | Example 2b: Megalitres: Reporting Worksheet

Example Audit 1a:

AWWA Free Water Audit Software:
Reporting Worksheet

Click to access definition
Click to add a comment

Water Audit Report for: City of Asheville (01-11-010)
Reporting Year: 2013 7/2012 - 6/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<----------- Enter grading in column 'E' and 'J' ----------->

WATER SUPPLIED

	Grade	Value	Units	Master Meter Error Adjustments: Grade	Pcnt	Value	Units
Volume from own sources:	7	7,352.880	MG/Yr	3		285.450	MG/Yr
Water imported:	n/a	0.000	MG/Yr				MG/Yr
Water exported:	n/a	0.000	MG/Yr				MG/Yr
WATER SUPPLIED:		**7,067.430**	MG/Yr				

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Click here: for help using option buttons below

	Grade	Value	Units	Pcnt	Value	Units
Billed metered:	8	4,782.250	MG/Yr			
Billed unmetered:	n/a	0.000	MG/Yr			
Unbilled metered:	7	27.757	MG/Yr			
Unbilled unmetered:	8	157.790	MG/Yr		157.790	MG/Yr

Unbilled Unmetered volume entered is greater than the recommended default value

AUTHORIZED CONSUMPTION: **4,967.797** MG/Yr

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption) **2,099.633** MG/Yr

Apparent Losses

	Grade	Value	Units	Pcnt	Value	Units
Unauthorized consumption:		17.669	MG/Yr	0.25%		MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

	Grade	Value	Units	Pcnt	Value	Units
Customer metering inaccuracies:	7	111.220	MG/Yr	2.26%		MG/Yr
Systematic data handling errors:	5	11.956	MG/Yr	0.25%		MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: **140.844** MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **1,958.789** MG/Yr

WATER LOSSES: **2,099.633** MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: **2,285.180** MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

	Grade	Value	Units
Length of mains:	4	1,236.5	miles
Number of active AND inactive service connections:	7	55,256	
Service connection density:		45	conn./mile main

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line: (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

	Grade	Value	Units
Average operating pressure:	4	145.3	psi

COST DATA

	Grade	Value	Units
Total annual cost of operating water system:	10	$33,630,676	$/Year
Customer retail unit cost (applied to Apparent Losses):	10	$3.22	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	8	$335.94	$/Million gallons

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

*** YOUR SCORE IS: 72 out of 100 ***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Variable production cost (applied to Real Losses)
3: Unauthorized consumption

Example Audit 1b:

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: City of Asheville (01-11-010)
Reporting Year: 2013 | 7/2012 - 6/2013

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 *****

System Attributes:

Apparent Losses:	140.844	MG/Yr
+ Real Losses:	1,958.789	MG/Yr
= **Water Losses:**	**2,099.633**	MG/Yr
Unavoidable Annual Real Losses (UARL):	794.34	MG/Yr
Annual cost of Apparent Losses:	$606,265	
Annual cost of Real Losses:	$658,036	Valued at **Variable Production Cost** Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	32.3%	
	Non-revenue water as percent by cost of operating system:	3.9%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.98	gallons/connection/day
	Real Losses per service connection per day:	97.12	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.67	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	1,958.79	million gallons/year
	Infrastructure Leakage Index (ILI) [CARL/UARL]:	2.47	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

Example Audit 2a:

AWWA Free Water Audit Software: Reporting Worksheet

Click to access definition
Click to add a comment

Water Audit Report for: **The City of Calgary**
Reporting Year: **2013** 1/2013 - 12/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MEGALITRES (THOUSAND CUBIC METRES) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<----------- Enter grading in column 'E' and 'J' ---------->

WATER SUPPLIED

	Grade	Value	Units	Master Meter Error Adjustments: Grade	Pcnt	Value
Volume from own sources:	7	174,324.000	ML/Yr	7	1.00%	ML/Yr
Water imported:	n/a	0.000	ML/Yr			ML/Yr
Water exported:	7	8,190.131	ML/Yr	7	1.00%	ML/Yr
WATER SUPPLIED:		**164,488.979**	ML/Yr			

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Click here: for help using option buttons below

	Grade	Value	Units	Pcnt	Value
Billed metered:	6	125,111.268	ML/Yr		
Billed unmetered:	8	3,503.386	ML/Yr		
Unbilled metered:	7	166.157	ML/Yr		
Unbilled unmetered:	6	1,444.000	ML/Yr		1,444.000 ML/Yr
AUTHORIZED CONSUMPTION:		**130,224.811**	ML/Yr		

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption)

34,264.168 ML/Yr

Apparent Losses

	Grade	Value	Units	Pcnt	Value
Unauthorized consumption:		411.222	ML/Yr	0.25%	ML/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

	Grade	Value	Units	Pcnt	Value
Customer metering inaccuracies:	6	1,265.429	ML/Yr	1.00%	ML/Yr
Systematic data handling errors:		312.778	ML/Yr	0.25%	ML/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: **1,989.429** ML/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **32,274.739** ML/Yr

WATER LOSSES: **34,264.168** ML/Yr

NON-REVENUE WATER

NON-REVENUE WATER: **35,874.325** ML/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

	Grade	Value	Units
Length of mains:	8	4,945.0	kilometers
Number of active AND inactive service connections:	8	312,075	
Service connection density:		63	conn./km main
Are customer meters typically located at the curbstop or property line?		No	
Average length of customer service line:	8	12.0	metres
Average operating pressure:	8	50.8	metres (head)

(length of service line, beyond the property boundary, that is the responsibility of the utility)

COST DATA

	Grade	Value	Units
Total annual cost of operating water system:	9	$169,973,759	$/Year
Customer retail unit cost (applied to Apparent Losses):	9	$2.35	$/1000 litres
Variable production cost (applied to Real Losses):	9	$73.54	$/Megalitre

☑ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 72 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Billed metered
3: Customer metering inaccuracies

Example Audit 2b:

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

Water Audit Report for: **The City of Calgary**
Reporting Year: **2013** **1/2013 - 12/2013**

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 *****

System Attributes:

Apparent Losses	1,989.429	ML/Yr
+ Real Losses:	32,274.739	ML/Yr
= **Water Losses:**	**34,264.168**	ML/Yr
Unavoidable Annual Real Losses (UARL):	8,015.57	ML/Yr
Annual cost of Apparent Losses	$4,675,159	
Annual cost of Real Losses	$75,845,637	Valued at **Customer Retail Unit Cost**
		Return to Reporting Worksheet to change this assumption

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	21.8%	
	Non-revenue water as percent by cost of operating system:	49.6%	Real Losses valued at Customer Retail Unit Cost
Operational Efficiency:	Apparent Losses per service connection per day	17.47	litres/connection/day
	Real Losses per service connection per day	283.34	litres/connection/day
	Real Losses per length of main per day*	N/A	
	Real Losses per service connection per day per meter (head) pressure:	5.58	litres/connection/day/m
	From Above, Real Losses = Current Annual Real Losses (CARL):	32,274.74	ML/year
	Infrastructure Leakage Index (ILI) [CARL/UARL]:	4.03	

* This performance indicator applies for systems with a low service connection density of less than 20 service connections/kilometre of pipeline

www.awwa.org

AWWA Free Water Audit Software: Acknowledgements

WAS v5.0

AWWA Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

DEVELOPED BY:

Andrew Chastain-Howley, PG, MCSM. Black & Veatch*
Will J. Jernigan, P.E. Cavanaugh & Associates, P.A.
George Kunkel, P.E. Philadelphia Water Department
Alain Lalonde, P.Eng. Master Meter Canada Inc.
Ralph Y. McCord, P.E. Louisville Water Company
David A. Sayers Delaware River Basin Commission
Brian M. Skeens, P.E. CH2M HILL
Reinhard Sturm Water Systems Optimization, Inc.
John H. Van Arsdel M.E. Simpson Company, Inc.

REFERENCES:

- *Alegre, H., Himer, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272*
- *Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65*
- *AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009*
- *Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.*

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.

This page intentionally left blank.

APPENDIX H

Conservation Tracking Model Summary

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

SFPUC Conservation Tracking Model

Overview of Model Structure and Calculation of Water Savings

David Mitchell, M.Cubed

Last Updated: 02-26-2016

Overview

The Conservation Tracking Model is a tool developed to track conservation program activity, water savings, and costs and benefits for SFPUC's retail service area conservation programs. The model is a customization of the Alliance for Water Efficiency's Water Conservation Tracking Tool, an Excel-based water conservation tracking model with more than three hundred registered water utility users throughout North America. The model replaces SFPUC's Retail Demand Model for estimating water savings from conservation.

Need for Conservation Tracking Model

The decision to transition to the Conservation Tracking Model was based on two primary considerations. First, SFPUC adopted a new approach to forecasting retail water demand based on econometric demand models developed by Brattle Group. Previously, SFPUC used the Retail Demand Model to forecast future retail water use. The Brattle Group demand forecast models have replaced the Retail Demand Model. However, the Brattle Group forecast models do not project water savings from SFPUC's conservation programs. Those savings have to be estimated separately and then used to adjust the Brattle Group forecast. This requirement led to the second consideration for transitioning to the Conservation Tracking Model. While it would be possible to continue estimating conservation savings using the Retail Demand Model, there were several disadvantages to doing so. First, it would require maintaining and continually updating the Retail Demand Model, which is a complicated and time-intensive task. Second, the structure of the Retail Demand Model makes it difficult to add new conservation programs to it. This meant that anytime SFPUC added new programs to its conservation portfolio it would face a daunting programming task to update the Retail Demand Model. Third, the Retail Demand Model's complex structure limited its usability by SFPUC staff. The Retail Demand Model requires specialized knowledge of its structure and operation which most staff within SFPUC do not possess. By contrast, the Conservation Tracking Model uses a simple data table structure that makes adding, modifying, and deleting conservation programs from the model straightforward. It also has a simpler user interface and where the Retail Demand Model was spread across five separate workbook files, the Conservation Tracking Model resides in one.

Model Structure

The Conservation Tracking Model is an Excel-based model with an extensive Visual Basic backend. Using the model requires completing Model Setup, Program Specification, and Annual Activity data input tasks. Each data input task is contained on a separate worksheet in the model.

Model Setup consists of providing the model with the baseline forecasts of population, housing units, and water demand, as well as other basic system information the model uses to calculate the costs and benefits of conservation programs. The baseline water demand forecast comes from the Brattle Group econometric demand models. The baseline population forecast is from the Association of Bay Area Governments (ABAG).

Program Specification consists of parameterizing the conservation programs in the model. The model can hold up to 75 separate programs. The model can be extended to hold more than 75 programs if needed. Program parameters are grouped into five categories: water saving parameters, utility cost parameters, participant cost parameters, participant non water benefits parameters, and plumbing code parameters. The latter are used to specify interaction effects with plumbing codes to avoid double counting water savings jointly produced by plumbing codes and conservation programs. In terms of

forecasting conservation program water savings, the most important parameters are the water savings parameters and the plumbing code interaction parameters.

Annual Activity is simply the number of units of activity that have been done (in the case of historical years) or are expected to be done (in the case of future years). The user enters historical and projected annual activity for each conservation program that was specified during the Program Specification step. For toilets, urinals, and clothes washers, the model includes fixture inventory modules to keep track of how many fixtures have been converted to efficient fixtures due to plumbing codes and conservation programs to ensure the user does not specify levels of fixture replacement that are physically infeasible.

Once the three data input tasks have been completed the model results can be reviewed. Model results are summarized into three categories: (1) program water savings, (2) retail water demand, and (3) costs and benefits.

- Program water savings are the projected annual water savings from each specified conservation program through 2040. Results can be grouped by program category and customer class or shown individually.

- Retail demand results summarize the baseline annual demand forecast with plumbing code and conservation program adjustments through 2040. It is grouped by customer class and shown separately for the in-city and suburban parts of SFPUC's retail service area. Results can be shown in MGD or acre-feet. Gross per capita and residential per capita water use are also reported. In addition, projected per capita water use is compared to per capita water use targets under SBx7-7 and the MOU.

- Costs and benefits of conservation are reported for the utility and program participant perspectives. Unit costs, net present value, and benefit-cost ratios can be reported for the totality of all programs, for individual program categories (e.g. toilet replacement programs), or for individual programs. In addition to financial benefits and costs, the model calculates expected reductions in associated energy use and greenhouse gas emissions.

Model inputs can be saved as scenarios. This allows the model to simultaneously hold more than one set of data inputs. For example, a user could specify scenarios for alternative baseline population and demand forecasts or for alternative levels of conservation program investment. There is no practical limit to the number of scenarios the model can hold.

Comparison with 2011 Conservation Plan

The conservation program savings presented in SFPUC's 2011 Conservation Plan were developed with the Retail Demand Model not the Conservation Tracking Model. While the Conservation Tracking Model can be calibrated to replicate the 2011 estimates, the final estimates developed for the 2015 Conservation Plan, which are based on the Conservation Tracking Model, are generally lower after 2020. There are three main reasons for the lower estimates. First, following the preparation of the 2011 Conservation Plan, SFPUC undertook a review of the water saving estimates and assumptions and made several adjustments. The most significant adjustments were made to the savings estimates for clothes washers and toilets, both of which were lowered to account for new efficiency standards affecting the long-term savings potential of these programs. Second, whereas the 2011 Plan continued implementation of toilet and clothes washer rebate programs through the entire forecast period, the

2015 Plan assumes these programs will be phased out after 2020 due to high fixture saturation levels. In fact, analysis done since the preparation of the 2011 Plan indicates the levels of forecasted activity after 2020 in the 2011 Plan would not be feasible in some cases given the estimated number of remaining inefficient toilets and washers in SFPUC's retail service area. Third, the focus of the 2015 Plan is on the next five years. After 2020 there is much less certainty regarding what conservation programs SFPUC will find most beneficial and cost-effective to implement. Therefore, the estimates only carry forward SFPUC's foundational customer assistance survey, audit, and grant programs after 2020, which when coupled with the phase out of toilet and washer rebate programs causes water savings after 2020 to tail off. The tailing off is somewhat artificial because it is expected SFPUC will implement new programs in addition to its foundational customer assistance programs after 2020, but there is not enough certainty about what these new programs will be or will entail to incorporate them into the forecast. In this regard, the 2015 Plan provides a very conservative estimate of the long-range (post 2020) level of conservation.

Calculation of Plumbing Code Water Savings

The Conservation Tracking Model calculates the water savings associated with plumbing codes and appliance efficiency standards using models of fixture inventory coupled with usage assumptions. These savings are commonly referred to as passive water savings because they occur regardless of the utilities actions. The Tracking Model includes passive savings models for residential toilets, showerheads, and clothes washers, and non-residential toilets, urinals, hotel showerheads, and coin-op clothes washers.

It is important to emphasize that the passive savings estimates do not actually impact the model's estimates of final water demand. This is because the Brattle Group's baseline demand forecasts used in the Tracking Model are supposedly already net of passive water savings. However, the Brattle forecast does not generate an explicit forecast of passive water savings because the adjustment for passive savings is enacted through the model's trend term. Because SFPUC desired explicit estimates of passive water savings, modules for estimating these savings were included in the Tracking Model. These estimates are added to the Brattle Group's baseline forecast before it is used in the model so that they can be represented explicitly. It is the Brattle Group's baseline forecast adjusted for passive savings that is entered on the Model Setup worksheet. The adjusted baseline forecast is:[1]

Adjusted Baseline Forecast = Brattle Baseline Forecast + Passive Water Savings

The final demand forecast generated by the Tracking Model is then:

Final Demand Forecast = Adjusted Baseline Forecast – Passive Water Savings – Program Water Savings

This is also equal to:

Final Demand Forecast = Brattle Baseline Forecast – Program Water Savings

[1] The passive water savings adjustment also includes water savings expected to be realized after 2015 from the historical implementation of SFPUC conservation programs prior to the start of the Brattle Group's baseline forecast. This is done to prevent the model from double counting these water savings.

This means the only determinants of the final demand forecast are the Brattle Baseline Forecast and the forecast of programmatic water savings from future implementation of SFPUC conservation programs. While the passive savings forecast is useful because it provides an estimate of how much future demand reduction can be ascribed to plumbing codes and appliance standards, it does not actually affect the final estimate of future demand.

Following are descriptions of how passive savings are calculated for each fixture/appliance category.

Residential Toilets

The population of residential toilets is based on SFPUC's forecasts of single and multi-family housing units. These forecasts are multiplied by the average number of toilets per dwelling unit, which are estimated from recent American Housing Survey data. The model uses an average of 2.21 and 1.38 toilets per dwelling unit for single and multi-family housing, respectively. Toilets installed in new housing constructed between 1991 and 2013 are assumed to be ULFT (1.6 gpf). Toilets installed in new housing constructed after 2013 are assumed to be HET (1.28 gpf). Toilets in existing housing constructed before 1991 are assumed to have an average flush volume of 3.5 gpf. Toilets in existing housing are assumed to be replaced at an annual rate of 3.1% per year. This is the average rate of residential toilet replacement reported in studies done by EBMUD and SCVWD. Existing toilets replaced between 1991 and 2013 are assumed to be replaced by ULFTs. Existing toilets replaced after 2013 are assumed to be replaced by HETs. Using this information, the model calculates the average flush volume for the inventory of new and existing toilets for each year between 1990 and 2064. Water savings per flush is calculated relative to the average flush volume in 1990. Average savings per flush is equal to the average flush volume in 1990 less the average flush volume in each year after 1990. Average savings per flush is multiplied by the estimated number of flushes per year to estimate annual water savings. The estimated number of flushes per year is equal to the residential population multiplied by the average daily per capita flush rate multiplied by 365. The residential population is derived from SFPUC's service area population forecasts. The average daily per capita flush rate of 4.8 is taken from the San Francisco Residential End Uses of Water Study.

Non-Residential Toilets

The population of non-residential toilets for the period 1990-2012 is taken from the Fixture Saturation Task Memo. The population of non-residential toilets for the period 2013-2064 is a linear extrapolation based on the forecast of service area population. The same assumptions used for residential toilets regarding flush volume of new toilets and replacement rate of existing toilets are used for non-residential toilets. The average flush volume of the toilet inventory and the water savings per flush relative to 1990 are calculated the same way as for residential toilets. Average savings per flush is multiplied by the estimated number of flushes per year to estimate annual water savings. To calculate total flushes per year, male and female workers are assumed to have daily flush rates of 1 and 3, respectively, per Vickers (2001). Male workers are assumed to comprise 54% of the labor force, per City of San Francisco (2009). Total employment is taken from SFPUC's employment forecast.

Non-Residential Urinals

The population of non-residential urinals for the period 1990-2012 is taken from the Fixture Saturation Task Memo. The population of non-residential urinals for the period 2013-2064 is a linear extrapolation based on the forecast of service area population. Urinals installed before 2014 are assumed to have a flush volume of 1.0 gpf. Urinals installed in 2014 are assumed to have a flush volume of 0.5 gpf. Urinals installed after 2014 are assumed to have a flush volume of 0.125 gpf. Urinals are assumed to have the same replacement rate as toilets. The average flush volume of the urinal inventory and the water

savings per flush relative to 1990 are calculated the same way as for residential and commercial toilets. Average savings per flush is multiplied by the estimated number of flushes per year to estimate annual water savings. To calculate total flushes per year, male workers are assumed to have a daily flush rate of 2, per Vickers (2001). Male workers are assumed to comprise 54% of the labor force, per City of San Francisco (2009). Total employment is taken from SFPUC's employment forecast.

Residential Showerheads

The population of residential showerheads is based on SFPUC's forecasts of single and multi-family housing units. These forecasts are multiplied by the average number of showerheads per dwelling unit, which are estimated from recent American Housing Survey data. The model uses an average of 1.34 and 1.21 showerheads per dwelling unit for single and multi-family housing, respectively. Showerheads installed in new housing constructed before 2005 are assumed to have an average flow rate of 2.3 gpm. Showerheads installed in new housing constructed between 2005 and 2017 are assumed to have an average flow rate of 2.0 gpm. Showerheads installed after 2017 are assumed to have an average flow rate of 1.8 gpm. Showerheads in existing housing are assumed to be replaced at an annual rate of 12% per year, per the Alliance for Water Efficiency. Using this information, the model calculates the average showerhead flow rate for the inventory of new and existing showerheads for each year between 2005 and 2064. Average savings per minute is equal to the average flow rate in 2005 less the average flow rate in each year after 2005. Annual water savings is calculated as the product of the average flow rate and the annual number of minutes for showering. The annual number of minutes for showering is equal to the average number of shower events per household per day multiplied by the average shower duration in minutes multiplied by the number of households multiplied by 365. An average of 2 shower events per day and an average duration of 9 minutes per shower event are taken from the San Francisco Residential End Uses of Water Study.[2] The number of residential housing units is taken from SFPUC's housing forecast.

Hotel Showerheads

The population of hotel showerheads is based on an estimate of the total number of hotel rooms in San Francisco. The model assumes one showerhead per room. Showerheads installed before 2005 are assumed to have an average flow rate of 2.5 gpm. Showerheads installed between 2005 and 2017 are assumed to have an average flow rate of 2.2 gpm. Showerheads installed after 2017 are assumed to have an average flow rate of 1.8 gpm. Showerheads are assumed to be replaced at an annual rate of 12% per year, per the Alliance for Water Efficiency. Using this information, the model calculates the average showerhead flow rate for the inventory of new and existing showerheads for each year between 2005 and 2064. Average savings per minute is equal to the average flow rate in 2005 less the average flow rate in each year after 2005. Annual water savings is calculated as the product of the average flow rate and the annual number of minutes for showering. The annual number of minutes for showering is equal to the average number of shower events per occupied room per day multiplied by the average shower duration in minutes multiplied by the number of occupied rooms multiplied by 365. An average of 1.34 shower events per day per occupied room and an average duration of 10 minutes per shower event are taken from the AWWARF Commercial End Uses of Water Study. The average hotel occupancy rate is based on a review of various estimates published on the internet of hotel occupancy in San Francisco.

---

[2] The estimate of average number of shower events per day from the San Francisco Residential End Uses of Water Study is used directly in the single-family residential calculation. For the multi-family calculation, it is scaled by the ratio of multi-family to single-family persons per household to take into account the lower density in multi-family housing.

Residential Clothes Washers

The population of residential clothes washers is based on SFPUC's housing forecast and the average number of washers per dwelling unit. The average number of washers per dwelling unit is taken from the Fixture Saturation Task Memo. The estimate of multi-family includes both in-unit and common room washers. New washers are assumed to be either conventional or high-efficiency based on a forecast of market shares informed by existing and pending federal efficiency standards for residential clothes washers. Existing washers are assumed to be replaced at an annual rate of 7.1%, which is equivalent to assuming washers have an average useful life of 14 years, which is consistent with industry estimates. When a washer is replaced, it is replaced with either a conventional or high efficiency washer according to a forecast of market shares informed by existing and pending federal efficiency standards for residential clothes washers. The Tracking Model allocates new high efficiency washers between top- and front-load models according to a forecast of market shares for top- and front-load washers based on DOE and EPA market forecasts. Under federal appliance efficiency regulations, top-load washers are allowed higher water factors than front-load washers. The water factors for new top- and front-load high-efficiency washers are dictated by existing and pending federal regulations.[3] Conventional washers are assumed to have an average water factor of 11. The average water factor for the inventory of residential washers in each forecast year is a weighted average of new and existing conventional, top-load, and front-load washers in that year. The average water factor for the period 2005-2010 in the single family washer model calibrates almost exactly to the estimate of average water use per single family washer reported in the San Francisco End Uses of Water Study for the same period. Water savings per load in each forecast year is equal to the average water use per load in 2005 minus the average water use per load in the forecast year. This is multiplied by total loads per year to get annual water savings. Total loads per year is equal to the number of washers multiplied by the average number of loads per day per washer multiplied by 365. The average number of loads per day per washer is taken from the San Francisco End Uses of Water Study.[4]

Coin-op Clothes Washers

Estimates of passive water savings for coin-op clothes washers use the same methodology used for residential clothes washers. The population of coin-op clothes washers is based on an internet search of coin-op washer facilities in San Francisco. The average number of washers per coin-op facility is taken from the Fixture Saturation Task Memo. The average number of loads per day is taken from a PG&E study of coin-op washer water and energy consumption. The water factors for new and replaced washers are based on existing and pending federal efficiency regulations for commercial clothes washers.

[3] The pending regulations take effect in 2018.

[4] The multi-family model scales the single-family estimate of loads per day by the ratio of multi-family to single-family persons per household to account for the lower number of persons per household in multi-family housing. The multi-family model also incorporates loads per day for common room clothes washers. Common room clothes washers are assumed to average 8 loads per day. Average loads per day for the multi-family model is a weighted average of loads per day for in-unit and common room clothes washers.

Calculation of Programmatic Water Savings

The Conservation Tracking Model calculates the water savings associated with a program as the product of the estimated water savings per unit of activity and the amount of activity completed. These savings are commonly referred to as active water savings because they result from the utility's direct investment in conservation programs intended to reduce demand. In other words, the savings result from the utility's active pursuit of demand reduction.

In the Tracking Model, the user specifies a starting unit water savings for each program. The behavior and duration of the unit savings overtime can then be adjusted with the useful life, annual decay, and plumbing code interaction parameters. When the annual decay and plumbing code interaction parameters are both set to 0, annual savings is equal to the product of the initial unit savings and the amount of activity. Annual savings accrue until the measure's useful life is reached, after which annual savings are assumed to be zero. Thus given initial unit savings S_0, measure useful life u, and activity of A_s in year s, water savings in any year t ≥ s are:

$$S_t = A_s S_0 \ if \ t - s + 1 \leq u, 0 \ otherwise$$

When the annual decay parameter takes a value d in the range (0, 1], annual water savings in any year t ≥ s are:

$$S_t = A_s S_0 (1 - d)^{t-s} \ if \ t - s + 1 \leq u, 0 \ otherwise$$

When the plumbing code interaction parameter takes a value p in the range (0, 1] and the plumbing code is in effect for any year t ≥ v, annual water savings in any year t ≥ s are:

$$S_t = \begin{cases} A_s S_0 \ if \ u \geq t - s + 1 \ and \ t < v \\ A_s (1 - p)^{t-s} S_0 \ if \ t - s + 1 \leq u \ and \ t \geq v \\ 0 \ if \ t - s + 1 > u \end{cases}$$

When the plumbing code interaction parameter takes a value p in the range (0, 1], the plumbing code is in effect for any year t ≥ v, and the annual decay parameter takes a value d in the range (0, 1], annual water savings in any year t ≥ s are:

$$S_t = \begin{cases} A_s S_0 (1 - d)^{t-s} \ if \ t - s + 1 \leq u \ and \ t < v \\ A_s (1 - p)^{t-s} S_0 (1 - d)^{t-s} \ if \ t - s + 1 \leq u \ and \ t \geq v \\ 0 \ if \ \ t - s + 1 > u \end{cases}$$

The specification of these parameters are based on current state and federal plumbing codes and appliance standards and findings from empirical evaluations of conservation program performance, as compiled by the California Urban Water Conservation Council (CUWCC) and Alliance for Water Efficiency (AWE). The specific data sources and assumptions used to create the water savings and plumbing code specifications for each program are provided in the remainder of this document.

The model's toilet fixture inventory modules for single- and multi-family toilets also estimate water savings from the City's toilet retrofit-on-resale ordinance that started in 2009. These estimates rest on two simplifying assumptions: (1) 3.5+ gpf toilets are uniformly distributed across the housing stock and

(2) each housing unit is equally likely to be put on the market for sale each year. Given these two assumptions, ROR toilet replacements in any year $t \geq 2009$ are calculated as:

(Stock of 3.5+ gpf toilets at beginning of year – SFPUC toilet replacements) x housing resale rate

The model assumes ROR toilets are replaced with ULFTs prior to 2014 and HETs thereafter.

References

A&N Technical Services (1991) Chesnutt, T.W. and C.N. McSpadden, "A Model-Based Evaluation of the Westchester Water Conservation Programs." Prepared for the Metropolitan Water District of Southern California, January.

A&N Technical Services (1992d) Chesnutt, T.W., C.N. McSpadden, S.A. Rahman, and A. Bamezai, "A Model-Based Evaluation of Irvine Ranch Water District Residential Retrofit and Survey Water Conservation Projects." Prepared for the Metropolitan Water District of Southern California, August.

A&N Technical Services (1994a) Bamezai, A. and T.W. Chesnutt, Public Facilities Toilet Retrofits: Evaluation of Program Outcomes and Water Savings, A report for the Metropolitan Water District of Southern California, December.

A&N Technical Services (1994b) Bamezai, A. and T.W. Chesnutt, "Residential Water Audit Program: Evaluation of Program Outcomes and Water Savings," A report for the Metropolitan Water District of Southern California, December.

Aquacraft (1999). Residential End Uses of Water Study.

California Urban Water Conservation Council. (2001). *CII ULFT Savings Study, 2nd Edition.* Sacramento: California Urban Water Conservation Council.

California Urban Water Conservation Council. (2005). *Draft Revision BMP Costs & Savings Study: A Guide to Data and Methods for Cost-Effectiveness Analysis of Urban Water Conservation Best Managemnet Practices.* Sacramento: California Urban Water Conservation Council.

Chesnutt, T.W., C.N. McSpadden, and D.M. Pekelney (1995), "What is the Reliable Yield from Residential Home Water Survey Programs?" presented at the AWWA Conference in Anaheim CA, June.

DeOreo, W., Mayer, P., Henderson, J., Raucher, B., Gleick, P., Cooley, H., & Heberger, M. (2010). *California Single Family Home Water Use Efficiency Study.* Bolder, CO: Aquacraft, Inc.

DeOreo, W., Mayer, P., Henderson, J., Raucher, B., Gleick, P., Cooley, H., & Heberger, M. (2010a). *San Francisco Single Family Home Water Use Efficiency Study.* Bolder, CO: Aquacraft, Inc.

Federal Energy Management Program (FEMP 2000), "Assessment of High-Performance, Family-Sized Commercial Clothes Washers." Produced for the U.S. Department of Energy by Pacific Northwest National Laboratory, May.

Koeller & Company (2005), "High Efficiency Plumbing Fixtures – Toilets and Urinals." Prepared analysis of Potential Best Management Practices for the California Urban Water Conservation Council.

Koeller, J. (2006). *A Report on Potential Best Management Practices: Year Two Annual Report.* Sacramento: California Urban Water Conservation Council.

M.Cubed (2014). SFPUC Plumbing Fixture Population and Efficiency Saturation Estimates. Technical Memorandum prepared for San Francisco Public Utilities Commission.

Mitchell D., and T. Chesnutt (2014). Evaluation of East Bay Municipal Utility District's Pilot of WaterSmart Home Water Reports. Prepared for California Water Foundation.

Sutter, M., T. Pope, and E. Walther (2006). Estimating Commercial Clothes Washer Use in California Coin Laundry Stores. ACEEE Summer Study on Energy Efficiency in Buildings.

U.S. Department of Energy (DOE 2006), "Energy Cost Calculator for Faucets and Showerheads," http://www1.eere.energy.gov/femp/procurement/eep_faucets_showerheads_calc.html#output . Last updated July 10, 2006.

U.S. Department of Energy (DOE 2012), Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Clothes Washers, April 2012. Accessed at http://www.regulations.gov/#!documentDetail;D=EERE-2008-BT-STD-0019-0047.

Whitcomb, J.B. (2000), "Residential Water Survey Evaluation," prepared for Contra Costa Water District, May.

This page intentionally left blank.

APPENDIX I

Wholesale Water Audit Worksheet

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

AWWA Free Water Audit Software v5.0

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person:	Chris Hewes	
Email Address:	chewes@rmcwater.com	
Telephone | Ext.:	415-321-3422	
Name of City / Utility:	San Francisco Public Utilities Commission - Wholesale	
City/Town/Municipality:	San Francisco	
State / Province:	California (CA)	
Country:	USA	
Year:	2015	Financial Year
Start Date:	07/2014	Enter MM/YYYY numeric format
End Date:	06/2015	Enter MM/YYYY numeric format
Audit Preparation Date:	2/4/2016	
Volume Reporting Units:	Million gallons (US)	
PWSID / Other ID:		

The following guidance will help you complete the Audit

All audit data are entered on the *Reporting Worksheet*

- Value can be entered by user
- Value calculated based on input data
- These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions — The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet — Enter the required data on this worksheet to calculate the water balance and data grading

Comments — Enter comments to explain how values were calculated or to document data sources

Performance Indicators — Review the performance indicators to evaluate the results of the audit

Water Balance — The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard — A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix — Presents the possible grading options for each input component of the audit

Service Connection Diagram — Diagrams depicting possible customer service connection line configurations

Definitions — Use this sheet to understand the terms used in the audit process

Loss Control Planning — Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits — Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements — Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at wlc@awwa.org

AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0

? Click to access definition
+ Click to add a comment

Water Audit Report for: San Francisco Public Utilities Commission - Wholesale
Reporting Year: 2015 | 7/2014 - 6/2015

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

WATER SUPPLIED

<----------- Enter grading in column 'E' and 'J' ---------->

Master Meter and Supply Error Adjustments

	Grade	Value	Units	Adj. Grade	Pcnt:	Value:	Units
Volume from own sources:	9	69,478.249	MG/Yr	8		-45.276	MG/Yr
Water imported:	n/a	0.000	MG/Yr				MG/Yr
Water exported:	8	223.000	MG/Yr	4		-3.396	MG/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 69,297.129 MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

	Grade	Value	Units
Billed metered:	9	69,334	MG/Yr
Billed unmetered:	n/a	0.000	MG/Yr
Unbilled metered:	10	22	MG/Yr
Unbilled unmetered:	8	106.900	MG/Yr

Unbilled unmetered — Pcnt: | Value: 106.900 MG/Yr

Use buttons to select percentage of water supplied **OR** value

AUTHORIZED CONSUMPTION: 69,462.479 MG/Yr

Check input values; WATER SUPPLIED should be greater than AUTHORIZED CONSUMPTION

WATER LOSSES (Water Supplied - Authorized Consumption)

-165.350 MG/Yr

Apparent Losses

	Grade	Value	Units	Pcnt:	Value:	Units
Unauthorized consumption:	5	43.311	MG/Yr		43.311	MG/Yr
Customer metering inaccuracies:	4	700.633	MG/Yr		700.633	MG/Yr
Systematic data handling errors:	9	28.755	MG/Yr		28.755	MG/Yr

Apparent Losses: 772.699 MG/Yr

Check input values; APPARENT LOSSES should be less than WATER LOSSES

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: -938.049 MG/Yr

WATER LOSSES: -165.350 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: -36.735 MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

	Grade	Value	Units
Length of mains:	8	235.5	miles
Number of active AND inactive service connections:	8	148	
Service connection density:		1	conn./mile main

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line: (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

	Grade	Value	Units
Average operating pressure:	6	104.0	psi

COST DATA

	Grade	Value	Units
Total annual cost of operating water system:	9	$200,595,848	$/Year
Customer retail unit cost (applied to Apparent Losses):	9	$2.93	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	8	$160.39	$/Million gallons

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 83 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Customer metering inaccuracies
2: Volume from own sources
3: Unauthorized consumption

WAS v5.0

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: San Francisco Public Utilities Commission - Wholesale
Reporting Year: 2015 | 7/2014 - 6/2015

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 83 out of 100 *****

System Attributes:

	Apparent Losses:	772.699	MG/Yr
+	Real Losses:	(938.049)	MG/Yr
=	**Water Losses:**	**(165.350)**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	49.21	MG/Yr
	Annual cost of Apparent Losses:	$3,026,539	
	Annual cost of Real Losses:	-$150,454	Valued at **Variable Production Cost** Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	-0.1%	
	Non-revenue water as percent by cost of operating system:	1.4%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	14303.94	gallons/connection/day
	Real Losses per service connection per day:	N/A	gallons/connection/day
	Real Losses per length of main per day*:	-10,912.94	gallons/mile/day
	Real Losses per service connection per day per psi pressure:	N/A	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	-938.05	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	-19.06	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software: User Comments

Use this worksheet to add comments or notes to explain how an input value was calculated, or to document the sources of the information used.

General Comment:	

Audit Item	Comment
Volume from own sources:	Provided by daily summed volumes of all relevant meters in the RWS, upkept by SFPUC staff.
Vol. from own sources: Master meter error adjustment:	Individual meter calibration records and other pertinent information provided by SFPUC staff - calculated separately for each meter.
Water imported:	n/a
Water imported: master meter error adjustment:	n/a
Water exported:	Summed from a weekly manual meter read.
Water exported: master meter error adjustment:	Assumed to be 98.5%, same as customer meters.
Billed metered:	Summed from a detailed billing system extract for each service point for each billing period. Prorated to adjust to audit time period. Filtered for non-potable accounts and other duplicate accounts.
Billed unmetered:	n/a
Unbilled metered:	(See Billed Metered)

Audit Item	Comment
Unbilled unmetered:	Summed from NPDES permit reporting which detail planned discharges of potable water to local watersheds.
Unauthorized consumption:	25% of default value used; wholesale system with little water theft expected.
Customer metering inaccuracies:	98.5% chosen for all customer meters (no recent meter testing, preventative maintenance has been relatively low in recent years due to ramped up WSIP construction in the transmission system).
Systematic data handling errors:	25% of default value used; billing system has been shown to be robust.
Length of mains:	Provided by SFPUC staff directly.
Number of active AND inactive service connections:	Provided by SFPUC staff directly.
Average length of customer service line:	n/a
Average operating pressure:	Weighted average of average PSI found in different lengths of transmission lines.
Total annual cost of operating water system:	Provided by SFPUC finance department, annual reporting of system costs.
Customer retail unit cost (applied to Apparent Losses):	Contractually calculated by the Wholesale Water Supply Agreement established in 2009 and audited anually (it is a unit cost, no fixed costs).
Variable production cost (applied to Real Losses):	Provided by SFPUC finance department calculations of treatment chemicals and power used by Water Supply and Treatment division.

AWWA Free Water Audit Software: Water Balance

WAS v5.0

Water Audit Report for:	San Francisco Public Utilities Commission - Wholesale	
Reporting Year:	2015	7/2014 - 6/2015
Data Validity Score:	83	

Own Sources (Adjusted for known errors) 69,523.525	System Input 69,523.525	Water Exported 226.396			Billed Water Exported	Revenue Water 226.396
		Water Supplied 69,297.129	Authorized Consumption 69,462.479	Billed Authorized Consumption 69,333.864	Billed Metered Consumption (water exported is removed) 69,333.864	Revenue Water 69,333.864
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 128.615	Unbilled Metered Consumption 21.715	Non-Revenue Water (NRW) -36.735
					Unbilled Unmetered Consumption 106.900	
			Water Losses -165.350	Apparent Losses 772.699	Unauthorized Consumption 43.311	
					Customer Metering Inaccuracies 700.633	
					Systematic Data Handling Errors 28.755	
Water Imported 0.000				Real Losses -938.049	Leakage on Transmission and/or Distribution Mains *Not broken down*	
					Leakage and Overflows at Utility's Storage Tanks *Not broken down*	
					Leakage on Service Connections *Not broken down*	

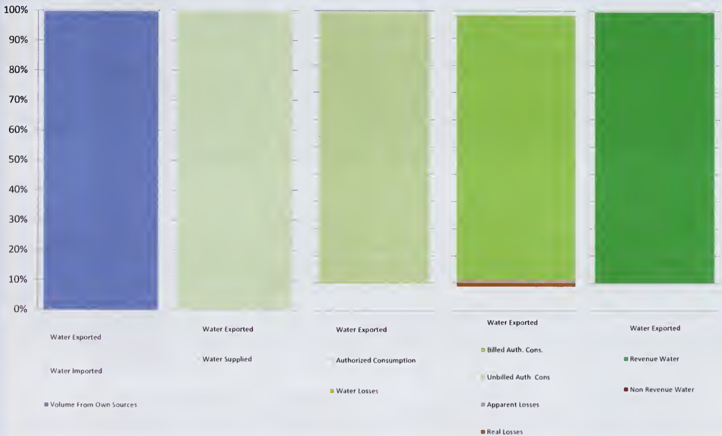
AWWA Free Water Audit Software: Dashboard

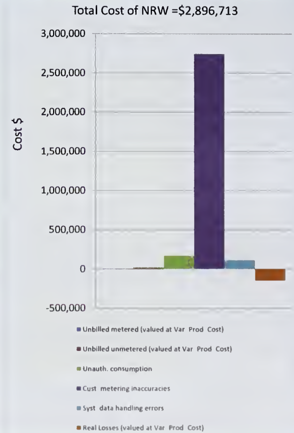
WAS v5.0

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

Water Audit Report for:	San Francisco Public Utilities Commission - Wholesale	
Reporting Year:	2015	7/2014 - 6/2015
Data Validity Score:	83	

Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software: Grading Matrix

The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
WATER SUPPLIED											
Volume from own sources:	Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)	Less than 25% of water production sources are metered, remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted	25% - 50% of treated water production sources are metered; other sources estimated. No regular meter accuracy testing or electronic calibration conducted	Conditions between 2 and 4	50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing or electronic calibration conducted	Conditions between 4 and 6	At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy	Conditions between 6 and 8	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowledgeable in the M36 methodology
Improvements to attain higher data grading for "Volume from own Sources" component		to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: Locate all water production sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered water production sources and replace any obsolete/defective meters		to qualify for 6: Formalize annual meter accuracy testing for all source meters, specify the frequency of testing. Complete installation of meters on unmetered water production sources and complete replacement of all obsolete/defective meters		to qualify for 8: Conduct annual meter accuracy testing and calibration of related instrumentation on all meter installations on a regular basis. Complete project to install new, or replace defective existing, meters so that entire production meter population is metered. Repair or replace meters outside of +/- 6% accuracy		to qualify for 10: Maintain annual meter accuracy testing and calibration of related instrumentation for all meter installations. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to further improve meter accuracy		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology
Volume from own sources master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its sources of supply	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition, data error cannot be determined	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls. Flows are not balanced across the water distribution system: tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and archived flow data is adjusted only when grossly evident data error occurs	Conditions between 2 and 4	Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. "Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities. Meter data is adjusted when gross data errors occur, or occasional meter testing deems this necessary	Conditions between 4 and 6	Hourly production meter data logged automatically & reviewed on at least a weekly basis. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing. Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and data gaps in the archived data are corrected on at least a weekly basis	Conditions between 6 and 8	Continuous production meter data is logged automatically & reviewed each business day. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and data gaps in the archived data are corrected on a daily basis	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically balances flows from all sources and storages; results are reviewed each business day. Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected. Regular calibrations between SCADA and sources meters ensures minimal data transfer error
Improvements to attain higher data grading for "Master meter and supply error adjustment" component		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature	to qualify for 4: Install automatic datalogging equipment on production meters. Complete installation of level instrumentation at all tanks/storage facilities and include tank level data in automatic calculation routine in a computerized system. Construct a computerized listing or spreadsheet to archive input volumes, tank/storage volume changes and import/export flows in order to determine the composite "Water Supplied" volume for the distribution system. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps		to qualify for 6: Refine computerized data collection and archive to include hourly production meter data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Use daily net storage change to balance flows in calculating "Water Supplied" volume. Necessary corrections to data errors are implemented on a weekly basis		to qualify for 8: Ensure that all flow data is collected and archived on at least an hourly basis. All data is reviewed and detected errors corrected each business day. Tank/storage levels variations are employed in calculating balanced "Water Supplied" component. Adjust production meter data for gross error and inaccuracy confirmed by testing		to qualify for 10: Link all production and tank/storage facility elevation change data to a Supervisory Control & Data Acquisition (SCADA) System, or similar computerized monitoring/control system, and establish automatic flow balancing algorithm and regularly calibrate between SCADA and source meters. Data is reviewed and corrected each business day		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters. Continue to replace or repair meters as they perform outside of desired accuracy limits. Stay abreast of new and more accurate water level instruments to better record tank/storage levels and archive the variations in storage volume. Keep current with SCADA and data management systems to ensure that archived data is well-managed and error free
Water Imported	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)	Less than 25% of imported water sources are metered, remaining sources are estimated. No regular meter accuracy testing	25% - 50% of imported water sources are metered; other sources estimated. No regular meter accuracy testing	Conditions between 2 and 4	50% - 75% of imported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted	Conditions between 4 and 6	At least 75% of imported water sources are metered, meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations. Less than 25% of tested meters are found outside of +/- 6% accuracy	Conditions between 6 and 8	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy
Improvements to attain higher data grading for "Water Imported Volume" component *(Note: usually the water supplier selling the water - "the Exporter" - to the utility being audited is responsible to maintain the metering installation measuring the imported volume. The utility should coordinate carefully with the Exporter to ensure that adequate meter upkeep takes place and an accurate measure of the Water Imported volume is quantified.)*		to qualify for 2: Review bulk water purchase agreements with partner suppliers; confirm requirements for use and maintenance of accurate metering. Identify needs for new or replacement meters with goal to meter all imported water sources	To qualify for 4: Locate all imported water sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered imported water interconnections and replace obsolete/defective meters		to qualify for 6: Formalize annual meter accuracy testing for all imported water meters, planning for both regular meter accuracy testing and calibration of the related instrumentation. Continue installation of meters on unmetered imported water interconnections and replacement of obsolete/defective meters		to qualify for 8: Complete project to install new, or replace defective, meters on all imported water interconnections. Maintain annual meter accuracy testing for all imported water meters and conduct calibration of related instrumentation at least annually. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Conduct meter accuracy testing for all meters on a semi-annual basis, along with calibration of all related instrumentation. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Continue to conduct calibration of related instrumentation on a semi-annual basis. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Water imported master meter and supply error adjustment	Select n/a if the Imported water supply is unmetered, with Imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility	Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition, data error cannot be determined. Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing	No automatic datalogging of imported supply volumes, daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing	Conditions between 2 and 4	Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented. Meter data is adjusted by the Exporter when gross data errors are detected. A coherent data trail exists for this process to protect both the selling and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management	Conditions between 4 and 6	Hourly imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected, and to correct for error confirmed by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling and the purchasing Utility	Conditions between 6 and 8	Continuous Imported supply metered flow data is logged automatically & reviewed each business day by the Exporter. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling and the purchasing Utility	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the Exporter. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling end purchasing Utility at least once every five years
Improvements to attain higher data grading for "Water imported master meter and supply error adjustment" component		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data, set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation and obtaining manufacturer literature. Review the written agreement between the selling and purchasing Utility	to qualify for 4: Install automatic datalogging equipment on imported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the Exporters to jointly review terms of the written agreements regarding meter accuracy testing and data management, revise the terms as necessary		to qualify for 6: Refine computerized data collection and archive to include hourly imported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis		to qualify for 8: Ensure that all imported supply metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day		to qualify for 10: Conduct accountability checks to confirm that all imported supply metered data is reviewed and corrected each business day by the Exporter. Results of all meter accuracy tests and data corrections should be available for sharing between the Exporter and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreement between the selling and the purchasing Utility, at least every five years		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters, work with the Exporter to help identify meter replacement needs. Keep communication lines with Exporters open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties
Water Exported	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)	Less than 25% of exported water sources are metered, remaining sources are estimated. No regular meter accuracy testing	25% - 50% of exported water sources are metered, other sources estimated. No regular meter accuracy testing	Conditions between 2 and 4	50% - 75% of exported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted	Conditions between 4 and 6	At least 75% of exported water sources are metered, meter accuracy testing and/or electronic calibration conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy	Conditions between 6 and 8	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy
Improvements to attain higher data grading for "Water Exported Volume" component *(Note: usually if the water utility being audited sells (Exports) water to a neighboring purchasing Utility, it is the responsibility of the utility exporting the water to maintain the metering installation measuring the Exported volume. The utility exporting the water should ensure that adequate meter upkeep takes place and an accurate measure of the Water Exported volume is quantified.)*		to qualify for 2: Review bulk water sales agreements with purchasing utilities, confirm requirements for use & upkeep of accurate metering. Identify needs to install new, or replace defective meters as needed	To qualify for 4: Locate all exported water sources on maps and in field, launch meter accuracy testing for existing meters, begin to install meters on unmetered exported water interconnections and replace obsolete/defective meters		to qualify for 6: Formalize annual meter accuracy testing for all exported water meters. Continue installation of meters on unmetered exported water interconnections and replacement of obsolete/defective meters		to qualify for 8: Complete project to install new, or replace defective, meters on all exported water interconnections. Maintain annual meter accuracy testing for all exported water meters. Repair or replace meters outside of +/- 6% accuracy		to qualify for 10: Maintain annual meter accuracy testing for all meters. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology
Water exported master meter and supply error adjustment	Select n/a only if the water utility fails to have meters on its exported supply interconnections	Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition, data error cannot be determined. Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing	No automatic datalogging of exported supply volumes, daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing	Conditions between 2 and 4	Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected. A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management	Conditions between 4 and 6	Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling the water. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected, and to correct for error found by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling (exporting) utility and the purchasing Utility	Conditions between 6 and 8	Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Water exported master meter and supply error adjustment" component		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data, set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the utility selling (exporting) the water and the purchasing Utility	to qualify for 4: Install automatic datalogging equipment on exported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the purchasing utilities to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary		to qualify for 6: Refine computerized data collection and archive to include hourly exported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis		to qualify for 8: Ensure that all exported metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day		to qualify for 10: Conduct accountability checks to confirm that all exported metered flow data is reviewed and corrected each business day by the utility selling the water. Results of all meter accuracy tests and data corrections should be available for sharing between the utility and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreements with the purchasing utilities, at least every five years		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters, work with the purchasing utilities to help identify meter replacement needs. Keep communication lines with the purchasing utilities open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties
AUTHORIZED CONSUMPTION											
Billed metered	n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero	Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population	At least 50% of customers with volume-based billing from meter reads; flat rate billing for others. Manual meter reading is conducted, with less than 50% meter read success rate, remaining accounts' consumption is estimated. Limited meter records, no regular meter testing or replacement. Billing data maintained on paper records, with no auditing	Conditions between 2 and 4	At least 75% of customers with volume-based, billing from meter reads; flat or fixed rate billing for remaining accounts. Manual meter reading is conducted with at least 50% meter read success rate, consumption for accounts with failed reads is estimated. Purchase records verify age of customer meters, only very limited meter accuracy testing is conducted. Customer meters are replaced only upon complete failure. Computerized billing records exist, but only sporadic internal auditing conducted	Conditions between 4 and 6	At least 90% of customers with volume-based billing from meter reads, consumption for remaining accounts is estimated. Manual customer meter reading gives at least 80% customer meter reading success rate, consumption for accounts with failed reads is estimated. Good customer meter records exist, but only limited meter accuracy testing is conducted. Regular replacement is conducted for the oldest meters. Computerized billing records exist with annual auditing of summary statistics conducting by utility personnel	Conditions between 6 and 8	At least 97% of customers exist with volume-based billing from meter reads. At least 90% customer meter reading success rate, or at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas. Good customer meter records. Regular meter accuracy testing guides replacement of statistically significant number of meters each year. Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years	Conditions between 8 and 10	At least 99% of customers exist with volume-based billing from meter reads. At least 95% customer meter reading success rate, or minimum 80% meter reading success rate, with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway. Statistically significant customer meter testing and replacement program in place on a continuous basis. Computerized billing with routine, detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years
Improvements to attain higher data grading for "Billed Metered Consumption" component	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures	to qualify for 4: Purchase and install meters on unmetered accounts. Implement policies to improve meter reading success. Catalog meter information during meter read visits to identify age/model of existing meters. Test a minimal number of meters for accuracy. Install computerized billing system		to qualify for 6: Purchase and install meters on unmetered accounts. Eliminate flat fee billing and establish appropriate water rate structure based upon measured consumption. Continue to achieve verifiable success in removing manual meter reading barriers. Expand meter accuracy testing. Launch regular meter replacement program. Launch a program of annual auditing of global billing statistics by utility personnel		to qualify for 8: Purchase and install meters on unmetered accounts. If customer meter reading success rate is less than 97%, assess cost-effectiveness of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system for portion or entire system, or otherwise achieve ongoing improvements in manual meter reading success rate to 97% or higher. Refine meter accuracy testing program. Set meter replacement goals based upon accuracy test results. Implement annual auditing of detailed billing records by utility personnel and implement third party auditing at least once every five years		to qualify for 10: Purchase and install meters on unmetered accounts. Launch Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system trials if manual meter reading success rate of at least 99% is not achieved within a five-year program. Continue meter accuracy testing program. Conduct planning and budgeting for large scale meter replacement based upon meter life cycle analysis using cumulative flow target. Continue annual detailed billing data auditing by utility personnel and conduct third party auditing at least once every three years		to maintain 10: Continue annual internal billing data auditing, and third party auditing at least every three years. Continue customer meter accuracy testing to ensure that accurate customer meter readings are obtained and entered as the basis for volume based billing. Stay abreast of improvements in Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) and information management. Plan and budget for justified upgrades in metering, meter reading and billing data management to maintain very high accuracy in customer metering and billing
Billed unmetered	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter; i.e. no intentionally unmetered accounts exist	Water utility policy does not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections or similar approach	Water utility policy does not require customer metering; flat or fixed fee billing is employed. Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods. Data from these sample meters are used to infer consumption for the total customer population. Site specific estimation methods are used for unusual buildings/water uses	Conditions between 2 and 4	Water utility policy does require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption; or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered. A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts	Conditions between 4 and 6	Water utility policy does require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings. As many as 15% of billed accounts are unmetered due to this exemption or meter installation difficulties. Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts	Conditions between 6 and 8	Water utility policy does require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances. The goal is to minimize the number of unmetered accounts. Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods	Conditions between 8 and 10	Water utility policy does require metering and volume based billing for all customer accounts. Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances. The goal exists to minimize the number of unmetered accounts to the extent that is economical. Reliable estimates of consumption are obtained at these accounts via site specific estimation methods

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Billed Unmetered Consumption" component		to qualify for 2 Conduct research and evaluate cost/benefit of a new water utility policy to require metering of the customer population, thereby greatly reducing or eliminating unmetered accounts Conduct pilot metering project by installing water meters in small sample of customer accounts and periodically reading the meters or datalogging the water consumption over one, three, or seven day periods	to qualify for 4 Implement a new water utility policy requiring customer metering Launch or expand pilot metering study to include several different meter types, which will provide data for economic assessment of full scale metering options Assess sites with access difficulties to devise means to obtain water consumption volumes Begin customer meter installation		to qualify for 6 Refine policy and procedures to improve customer metering participation for all but solidly exempt accounts Assign staff resources to review billing records to identify errant unmetered properties Specify metering needs and funding requirements to install sufficient meters to significant reduce the number of unmetered accounts		to qualify for 8 Push to install customer meters on a full scale basis Refine metering policy and procedures to ensure that all accounts, including municipal properties, are designated for meters Plan special efforts to address "hard-to-access" accounts Implement procedures to obtain a reliable consumption estimate for the remaining few unmetered accounts awaiting meter installation		to qualify for 10 Continue customer meter installation throughout the service area, with a goal to minimize unmetered accounts Sustain the effort to investigate accounts with access difficulties, and devise means to install water meters or otherwise measure water consumption		to maintain 10 Continue to refine estimation methods for unmetered consumption and explore means to establish metering, for as many billed remaining unmetered accounts as is economically feasible
Unbilled metered	select n/a if all billing-exempt consumption is unmetered	Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist; and a reliable count of unbilled metered accounts is unavailable Meter upkeep and meter reading on these accounts is rare and not considered a priority Due to poor recordkeeping and lack of auditing, water consumption for all such accounts is purely guesstimated	Billing practices exempt certain accounts, such as municipal buildings, but only scattered, dated written directives exist to justify this practice A reliable count of unbilled metered accounts is unavailable Sporadic meter replacement and meter reading occurs on an as-needed basis The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size	Conditions between 2 and 4	Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts Meter reading is given low priority and is sporadic Consumption is quantified from meter readings where available The total number of unbilled, unmetered accounts must be estimated along with consumption volumes	Conditions between 4 and 6	Written policies regarding billing exemptions exist but adherence in practice is questionable Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts Periodic auditing of such accounts is conducted Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated	Conditions between 6 and 8	Written policy identifies the types of accounts granted a billing exemption Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit. High level auditing of billing records ensures that a reliable census of such accounts exists	Conditions between 8 and 10	Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted Regular auditing confirms this Total water consumption for these accounts is taken from reliable readings from accurate meters
Improvements to attain higher data grading for "Unbilled Metered Consumption" component		to qualify for 2 Reassess the water utility's policy allowing certain accounts to be granted a billing exemption Draft an outline of a new written policy for billing exemptions, with clear justification as to why any accounts should be exempt from billing, and with the intention to keep the number of such accounts to a minimum	to qualify for 4 Review historic written directives and policy documents allowing certain accounts to be billing-exempt Draft an outline of a written policy for billing exemptions, identify criteria that grants an exemption, with a goal of keeping this number of accounts to a minimum Consider increasing the priority of reading meters on unbilled accounts at least annually		to qualify for 6 Draft a new written policy regarding billing exemptions based upon consensus criteria allowing this occurrence Assign resources to audit meter records and billing records to obtain census of unbilled metered accounts Gradually include a greater number of these metered accounts to the routes for regular meter reading		to qualify for 8 Communicate billing exemption policy throughout the organization and implement procedures that ensure proper account management Conduct inspections of accounts confirmed in unbilled metered status and verify that accurate meters exist and are scheduled for routine meter readings Gradually increase the number of unbilled metered accounts that are included in regular meter reading routes		to qualify for 10 Ensure that meter management (meter accuracy testing, meter replacement) and meter reading activities for unbilled accounts are accorded the same priority as billed accounts Establish ongoing annual auditing process to ensure that water consumption is reliably collected and provided to the annual water audit process		to maintain 10 Reassess the utility's philosophy in allowing any water uses to go "unbilled" It is possible to meter and bill all accounts, even if the fee charged for water consumption is discounted or waived Metering and billing all accounts ensures that water consumption is tracked and water waste from plumbing leaks is detected and minimized
Unbilled unmetered		Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping Total consumption is quantified based upon a purely subjective estimate	Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption but without sufficient documentation to quantify an accurate estimate of the annual volume consumed	Conditions between 2 and 4	Extent of unbilled unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events)	Default value of 1 25% of system input volume is employed	Coherent policies exist for some forms of unbilled, unmetered consumption but others await closer evaluation Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference, but unsupervised uses are guesstimated	Conditions between 6 and 8	Clear policies and good recordkeeping exist for some uses (ex water used in periodic testing of unmetered fire connections), but other uses (ex miscellaneous uses of fire hydrants) have limited oversight Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow, multiplied by number of events) or temporary meters and relatively subjective estimates of less regulated use	Conditions between 8 and 10	Clear policies exist to identify permitted use of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow multiplied by number of events) or use of temporary meters
Improvements to attain higher data grading for "Unbilled Unmetered Consumption" component		to qualify for 5 Utilize the accepted default value of 1 25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use to qualify for 2 Establish a policy regarding what water uses should be allowed to remain as unbilled and unmetered Consider tracking a small sample of one such use (ex fire hydrant flushings)	to qualify for 5 Utilize accepted default value of 1 25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use to qualify for 4 Evaluate the documentation of events that have been observed Meet with user groups (ex for fire hydrants - fire departments, contractors to ascertain their need and/or volume requirements for water from fire hydrants)		to qualify for 5 Utilize accepted default value of 1 25% of the volume of water supplied as an expedient means to gain a reasonable quantification of all such use This is particularly appropriate for water utilities who are in the early stages of the water auditing process and should focus on other components since the volume of unbilled unmetered consumption is usually a relatively small quantity component, and other larger-quantity components should take priority	to qualify for 6 or greater Finalize policy and begin to conduct field checks to better establish and quantify such usage Proceed if top-down audit exists and/or a great volume of such use is suspected	to qualify for 8 Assess water utility policy and procedures for various unmetered usages For example ensure that a policy exists and permits are issued for use of fire hydrants by persons outside of the utility Create written procedures for use and documentation of fire hydrants by water utility personnel Use same approach for other types of unbilled, unmetered water usage		to qualify for 10 Refine written procedures to ensure that all uses of unbilled unmetered water are overseen by a structured permitting process managed by water utility personnel Reassess policy to determine if some of these uses have value in being converted to billed and/or metered status		to maintain 10 Continue to refine policy and procedures with intention of reducing the number of allowable uses of water in unbilled and unmetered fashion Any uses that can feasibly become billed and metered should be converted eventually

APPARENT LOSSES

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Unauthorized consumption:		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping Total unauthorized consumption is guesstimated	Unauthorized consumption is a known occurrence, but its extent is a mystery There are no requirements to document observed events, but periodic field reports capture some of these occurrences Total unauthorized consumption is approximated from this limited data	conditions between 2 and 4	Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events)	Default value of 0 25% of volume of water supplied is employed	Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy Volumes quantified by inference from these records	Conditions between 6 and 8	Clear policies and good auditable recordkeeping exist for certain events (ex tampering with water meters, illegal bypasses of customer meters), but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption	Conditions between 8 and 10	Clear policies exist to identify all known unauthorized uses of water Staff and procedures exist to provide enforcement of policies and detect violations Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods All records and calculations should exist in a form that can be audited by a third party
Improvements to attain higher data grading for "Unauthorized Consumption" component:		<u>to qualify for 5</u> Use accepted default of 0 25% of volume of water supplied <u>to qualify for 2</u> Review utility policy regarding what water uses are considered unauthorized and consider tracking a small sample of one such occurrence (ex unauthorized fire hydrant openings)	<u>to qualify for 5</u> Use accepted default of 0 25% of system input volume <u>to qualify for 4</u> Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex unauthorized fire hydrant openings)		<u>to qualify for 5</u> Utilize accepted default value of 0 25% of volume of water supplied as an expedient means to gain a reasonable quantification of all such use This is particularly appropriate for water utilities who are in the early stages of the water auditing process	<u>to qualify for 6 or greater</u> Finalize policy updates to clearly identify the types of water consumption that are authorized from those usages that fall outside of this policy and are, therefore, unauthorized Begin to conduct regular field checks Proceed if the top-down audit already exists and/or a great volume of such use is suspected	<u>to qualify for 8</u> Assess water utility policies to ensure that all known occurrences of unauthorized consumption are outlawed, and that appropriate penalties are prescribed Create written procedures for detection and documentation of various occurrences of unauthorized consumption as they are uncovered.		<u>to qualify for 10</u> Refine written procedures and assign staff to seek out likely occurrences of unauthorized consumption Explore new locking devices, monitors and other technologies designed to detect and thwart unauthorized consumption		<u>to maintain 10</u> Continue to refine policy and procedures to eliminate any loopholes that allow or tacitly encourage unauthorized consumption Continue to be vigilant in detection, documentation and enforcement efforts
Customer metering inaccuracies:	select n/a only if the entire customer population is unmetered In such a case the volume entered must be zero	Customer meters exist, but with unorganized paper records on meters, no meter accuracy testing or meter replacement program for any size of retail meter Metering workflow is driven chaotically with no proactive management Loss volume due to aggregate meter inaccuracy is guesstimated	Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing Existing paper records gathered and organized to provide cursory disposition of meter population Customer meters are tested for accuracy only upon customer request	Conditions between 2 and 4	Reliable recordkeeping exists, meter information is improving as meters are replaced Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory) A limited number of the oldest meters are replaced each year Inaccuracy volume is largely an estimate, but refined based upon limited testing data	Conditions between 4 and 6	A reliable electronic recordkeeping system for meters exists The meter population includes a mix of new high performing meters and dated meters with suspect accuracy Routine, but limited, meter accuracy testing and meter replacement occur Inaccuracy volume is quantified using a mix of reliable and less certain data	Conditions between 6 and 8	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population Statistically significant number of meters are tested in audit year This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters	Good records of all active customer meters exist and include as a minimum meter number, account number/location, type, size and manufacturer Ongoing meter replacement occurs according to a targeted and justified basis Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population New metering technology is embraced to keep overall accuracy improving Procedures are reviewed by a third party knowledgeable in the M36 methodology
Improvements to attain higher data grading for "Customer meter inaccuracy volume" component:	If n/a is selected because the customer meter population is unmetered consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes	<u>to qualify for 2</u>: Gather available meter purchase records Conduct testing on a small number of meters believed to be the most inaccurate Review staffing needs of the metering group and budget for necessary resources to better organize meter management	<u>to qualify for 4</u> Implement a reliable record keeping system for customer meter histories, preferably using electronic methods typically linked to, or part of, the Customer Billing System or Customer Information System Expand meter accuracy testing to a larger group of meters		<u>to qualify for 8</u> Standardize the procedures for meter recordkeeping within an electronic information system Accelerate meter accuracy testing and meter replacements guided by testing results		<u>to qualify for 8</u> Expand annual meter accuracy testing to evaluate a statistically significant number of meter makes/models Expand meter replacement program to replace statistically significant number of poor performing meters each year.		<u>to qualify for 9</u>. Continue efforts to manage meter population with reliable recordkeeping Test a statistically significant number of meters each year and analyze test results in an ongoing manner to serve as a basis for a target meter replacement strategy based upon accumulated volume throughput	<u>to qualify for 10</u> Continue efforts to manage meter population with reliable recordkeeping, meter testing and replacement Evaluate new meter types and install one or more types in 5-10 customer accounts each year in order to pilot improving metering technology	<u>to maintain 10</u> Increase the number of meters tested and replaced as justified by meter accuracy test data Continually monitor development of new metering technology and Advanced Metering Infrastructure (AMI) to grasp opportunities for greater accuracy in metering of water flow and management of customer consumption data

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Systematic Data Handling Errors	Note all water utilities incur some amount of this error Even in water utilities with unmetered customer populations and fixed rate billing, errors occur in annual billing tabulations Enter a positive value for the volume and select a grading	Policies and procedures for activation of new customer water billing accounts are vague and lack accountability Billing data is maintained on paper records which are not well organized No auditing is conducted to confirm billing data handling efficiency An unknown number of customers escape routine billing due to lack of billing process oversight	Policy and procedures for activation of new customer accounts and oversight of billing records exist but need refinement Billing data is maintained on paper records or insufficiently capable electronic database Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency The volume of unbilled water due to billing lapses is a guess	Conditions between 2 and 4	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement Computerized billing system exists, but is dated or lacks needed functionality Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses	Conditions between 4 and 6	Policy and procedures for new account activation and oversight of billing operations is adequate and reviewed periodically Computerized billing system is in use with basic reporting available Any effect of billing adjustments on measured consumption volumes is well understood Internal checks of billing data error conducted annually Reasonably accurate quantification of consumption volume lost to billing lapses is obtained	Conditions between 6 and 8	New account activation and billing operations policy and procedures are reviewed at least biannually Computerized billing system includes an array of reports to confirm billing data and system functionality Checks are conducted routinely to flag and explain zero consumption accounts Annual internal checks conducted with third party audit conducted at least once every five years Accountability checks flag billing lapses Consumption lost to billing lapses is well quantified and reducing year-by-year	Conditions between 8 and 10	Sound written policy and procedures exist for new account activation and oversight of customer billing operations Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs
Improvements to attain higher data grading for "Systematic Data Handling Error volume" component		to qualify for 2 Draft written policy and procedures for activating new water billing accounts and oversight of billing operations investigate and budget for computerized customer billing system Conduct initial audit of billing records by flow-charting the basic business processes of the customer account/billing function	to qualify for 4 Finalize written policy and procedures for activation of new billing accounts and overall billing operations management Implement a computerized customer billing system Conduct initial audit of billing records as part of this process		to qualify for 6 Refine new account activation and billing operations procedures and ensure consistency with the utility policy regarding billing, and minimize opportunity for missed billings Upgrade or replace customer billing system for needed functionality - ensure that billing adjustments don't corrupt the value of consumption volumes Procedurize internal annual audit process		to qualify for 8 Formalize regular review of new account activation process and general billing practices Enhance reporting capability of computerized billing system Formalize regular auditing process to reveal scope of data handling error Plan for periodic third party audit to occur at least once every five years		to qualify for 10 Close policy/procedure loopholes that allow some customer accounts to go unbilled, or data handling errors to exist Ensure that billing system reports are utilized, analyzed and reported every billing cycle Ensure that internal and third party audits are conducted at least once every three years		to maintain 10 Stay abreast of customer information management developments and innovations Monitor developments of Advanced Metering Infrastructure (AMI) and integrate technology to ensure that customer endpoint information is well-monitored and errors/lapses are at an economic minimum
SYSTEM DATA											
Length of mains		Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible Length of mains is guesstimated	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments) Poor procedures to ensure that new water mains installed by developers are accurately documented	Conditions between 2 and 4	Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length	Conditions between 4 and 6	Sound written policy and procedures exist for permitting and commissioning new water mains Highly accurate paper records with regular field validation, or electronic records and asset management system in good condition Includes system backup	Conditions between 6 and 8	Sound written policy and procedures exist for permitting and commissioning new water mains Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data	Conditions between 8 and 10	Sound written policy exists for managing water mains extensions and replacements Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases Records of annual field validation should be available for review
Improvements to attain higher data grading for "Length of Water Mains" component		to qualify for 2 Assign personnel to inventory current as-built records and compare with customer billing system records and highway plans in order to verify poorly documented pipelines Assemble policy documents regarding permitting and documentation of water main installations by the utility and building developers, identify gaps in procedures that result in poor documentation of new water main installations	to qualify for 4 Complete inventory of paper records of water main installations for several years prior to audit year Review policy and procedures for commissioning and documenting new water main installation		to qualify for 6 Finalize updates/improvements to written policy and procedures for permitting/commissioning new main installations Confirm inventory of records for five years prior to audit year, correct any errors or omissions		to qualify for 8 Launch random field checks of limited number of locations Convert to electronic database such as a Geographic Information System (GIS) with backup as justified Develop written policy and procedures		to qualify for 10 Link Geographic Information System (GIS) and asset management databases, conduct field verification of data Record field verification information at least annually		to maintain 10 Continue with standardization and random field validation to improve the completeness and accuracy of the system
Number of active AND inactive service connections		Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections which may be 10-15% in error from actual count	General permitting policy exists but paper records procedural gaps and weak oversight result in questionable total for number of connections which may vary 5-10% of actual count	Conditions between 2 and 4	Written account activation policy and procedures exist but with some gaps in performance and oversight Computerized information management system is being brought online to replace dated paper recordkeeping system Reasonably accurate tracking of service connection installations & abandonments, but count can be up to 5% in error from actual total	Conditions between 4 and 6	Written new account activation and overall billing policies and procedures are adequate and reviewed periodically Computerized information management system is in use with annual installations & abandonments totaled Very limited field verifications and audits Error in count of number of service connections is believed to be no more than 3%	Conditions between 6 and 8	Policies and procedures for new account activation and overall billing operations are written well-structured and reviewed at least biannually Well managed computerized information management system exists and routine periodic field checks and internal system audits are conducted Counts of connections are no more than 2% in error	Conditions between 8 and 10	Sound written policy and well managed and audited procedures ensure reliable management of service connection population Computerized information management system, Customer Billing System and Geographic Information System (GIS) information agree, field validation proves truth of databases Count of connections recorded as being in error is less than 1% of the entire population
Improvements to attain higher data grading for "Number of Active and Inactive Service Connections" component	**Note The number of Service Connections does <u>not</u> include fire hydrant leads/lines connecting the hydrant to the water main**	to qualify for 2 Draft new policy and procedures for new account activation and overall billing operations Research and collect paper records of installations & abandonments for several years prior to audit year	to qualify for 4 Refine policy and procedures for new account activation and overall billing operations Research computerized recordkeeping system (Customer Information System or Customer Billing System) to improve documentation format for service connections		to qualify for 6 Refine procedures to ensure consistency with new account activation and overall billing policy to establish new service connections or decommission existing connections Improve process to include all totals for at least five years prior to audit year		to qualify for 8 Formalize regular review of new account activation and overall billing operations policies and procedures Launch random field checks of limited number of locations Develop reports and auditing mechanisms for computerized information management system		to qualify for 10 Close any procedural loopholes that allow installations to go undocumented Link computerized information management system with Geographic Information System (GIS) and formalize field inspection and information system auditing processes Documentation of new or decommissioned service connections encounters several levels of checks and balances		to maintain 10 Continue with standardization and random field validation to improve knowledge of system
	Note if customer water	Gradings 1-9 apply if customer properties are unmetered if customer meters exist and are located inside the customer building premises or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping and the typical first point of use (ex faucet) or the customer meter must be quantified Gradings of 1-9 are used to grade the validity of the means to quantify this value (See the "Service Connection Diagram" worksheet)									Either of two conditions can be met for a grading of 10

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Average length of customer service line	meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility, then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under the Grading of 10(a) will be followed, with a value of zero automatically entered at a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance	Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping. Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating this distance is arbitrary due to the unknown location of many curb stops	Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. The piping from the water main to the curb stop is the property of the water utility, and the piping from the curb stop to the customer building is owned by the customer. Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field	Conditions between 2 and 4	Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy	Conditions between 4 and 6	Clear written policy exists to define utility/customer responsibility for service connection piping. Accurate, well-maintained paper or basic electronic recordkeeping system exists. Periodic field checks confirm piping lengths for a sample of customer properties	Conditions between 6 and 8	Clearly worded policy standardizes the location of curb stops and meters, which are inspected upon installation. Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meter pits. An accurate number of customer properties from the customer billing system allows for reliable averaging of this length	Conditions between 8 and 10	a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Working asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet b) Meters exist inside customer buildings, or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks
Improvements to attain higher data grading for "Average Length of Customer Service Line" component		to qualify for 2 Research and collect paper records of service line installations. Inspect several sites in the field using pipe locators to locate curb stops. Obtain the length of this small sample of connections in this manner	to qualify for 4 Formalize and communicate policy delineating utility/customer responsibilities for service connection piping. Assess accuracy of paper records by field inspection of a small sample of service connections using pipe locators as needed. Research the potential migration to a computerized information management system to store service connection data		to qualify for 6 Establish coherent procedures to ensure that policy for curb stop, meter installation and documentation is followed. Gain consensus within the water utility for the establishment of a computerized information management system		to qualify for 8 Implement an electronic means of recordkeeping, typically via a customer information system, customer billing system, or Geographic Information System (GIS). Standardize the process to conduct field checks of a limited number of locations		to qualify for 10 Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data		to maintain 10 Continue with standardization and random field validation to improve knowledge of service connection configurations and customer meter locations
Average operating pressure		Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions. Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps. Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks. Pressure data is gathered at individual sites only when low pressure complaints arise. Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system	Conditions between 2 and 4	Effective pressure controls separate different pressure zones, moderate pressure variation across the system, occasional open boundary valves are discovered that breech pressure zones. Basic telemetry monitoring of the distribution system logs pressure data electronically. Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing. Reliable topographical data exists. Average pressure is calculated using this mix of data	Conditions between 4 and 6	Reliable pressure controls separate distinct pressure zones, only very occasional open boundary valves are encountered that breech pressure zones. Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically. Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing. Average pressure is determined by using this mix of reliable data	Conditions between 6 and 8	Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations. A current full-scale SCADA System or similar realtime monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system. The average system pressure is determined from reliable monitoring system data	Conditions between 8 and 10	Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system. Average system pressure is reliably calculated from extensive, reliable, and cross-checked data. Calculations are reported on an annual basis as a minimum
Improvements to attain higher data grading for "Average Operating Pressure" component		to qualify for 2 Employ pressure gauging and/or datalogging equipment to obtain pressure measurements from fire hydrants. Locate accurate topographical maps of service area in order to confirm ground elevations. Research pump data sheets to find pump pressure/flow characteristics	to qualify for 4 Formalize a procedure to use pressure gauging/datalogging equipment to gather pressure data during various system events such as low pressure complaints, or operational testing. Gather pump pressure and flow data at different flow regimes. Identify faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) and plan to properly configure pressure zones. Make all pressure data from these efforts available to generate system-wide average pressure		to qualify for 6 Expand the use of pressure gauging/datalogging equipment to gather scattered pressure data at a representative set of sites, based upon pressure zones or areas. Utilize pump pressure and flow data to determine supply head entering each pressure zone or district. Correct any faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) to ensure properly configured pressure zones. Use expanded pressure dataset from these activities to generate system-wide average pressure		to qualify for 8 Install a Supervisory Control and Data Acquisition (SCADA) System, or similar realtime monitoring system, to monitor system parameters and control operations. Set regular calibration schedule for instrumentation to insure data accuracy. Obtain accurate topographical data and utilize pressure data gathered from field surveys to provide extensive, reliable data for pressure averaging		to qualify for 10 Annually, obtain a system-wide average pressure value from the hydraulic model of the distribution system that has been calibrated via field measurements in the water distribution system and confirmed in comparisons with SCADA System data		to maintain 10 Continue to refine the hydraulic model of the distribution system and consider linking it with SCADA System for real-time pressure data calibration, and averaging

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
COST DATA											
Total annual cost of operating water system		Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to estimate the major portion of water system operating costs	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place However, gaps in data are known to exist, periodic internal reviews are conducted but not a structured financial audit	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA)	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked Data audited at least annually by utility personnel, and at least once every three years by third-party CPA.	Conditions between 8 and 10	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked Data audited annually by utility personnel and annually also by third-party CPA.
Improvements to attain higher data grading for "Total Annual Cost of Operating the Water System" component		to qualify for 2 Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions	to qualify for 4 Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6 Establish process for periodic internal audit of water system operating costs, identify cost data gaps and institute procedures for tracking these outstanding costs		to qualify for 8 Standardize the process to conduct routine financial audit on an annual basis Arrange for CPA audit of financial records at least once every three years		to qualify for 10 Standardize the process to conduct a third-party financial audit by a CPA on an annual basis		to maintain 10 Maintain program, stay abreast of expenses subject to erratic cost changes and long-term cost trend, and budget/track costs proactively
Customer retail unit cost (applied to Apparent Losses)	Customer population unmetered, and/or only a fixed fee is charged for consumption	Antiquated, cumbersome water rate structure is used, with periodic historic amendments that were poorly documented and implemented, resulting in classes of customers being billed inconsistent charges The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate	Dated, cumbersome water rate structure, not always employed consistently in actual billing operations The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified	Conditions between 2 and 4	Straight-forward water rate structure in use, but not updated in several years Billing operations reliably employ the rate structure The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the affect of different rates from varying customer classes	Conditions between 4 and 6	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block	Conditions between 6 and 8	Effective water rate structure is in force and is applied reliably in billing operations Composite customer rate is determined using a weighted average composite consumption rate, which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure	Conditions between 8 and 10	Current, effective water rate structure is in force and applied reliably in billing operations The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every five years
Improvements to attain higher data grading for "Customer Retail Unit Cost" component		to qualify for 2 Formalize the process to implement water rates, including a secure documentation procedure Create a current, formal water rate document and gain approval from all stakeholders	to qualify for 4 Review the water rate structure and update/formalize as needed Assess billing operations to ensure that actual billing operations incorporate the established water rate structure		to qualify for 6 Evaluate volume of water used in each usage block by residential users Multiply volumes by full rate structure	Launch effort to fully meter the customer population and charge rates based upon water volumes	to qualify for 8 Evaluate volume of water used in each usage block by all classifications of users Multiply volumes by full rate structure		to qualify for 10 Conduct a periodic third-party audit of water used in each usage block by all classifications of users Multiply volumes by full rate structure		to maintain 10 Keep water rate structure current in addressing the water utility's revenue needs Update the calculation of the customer unit rate as new rate components, customer classes, or other components are modified
Variable production cost (applied to Real Losses)	Note if the water utility purchases/imports its entire water supply, then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10	Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable) All costs are audited internally on a periodic basis	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply, are included in the unit variable production cost, as applicable The data is audited at least annually by utility personnel	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked The data is audited at least annually by utility personnel, and at least once every three years by a third-party knowledgeable in the M36 methodology	Conditions between 8 and 10	Either of two conditions can be met to obtain a grading of 10 1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis or 2) Water supply is entirely purchased as bulk water imported, and the unit purchase cost - including all applicable marginal supply costs - serves as the variable production cost If all applicable marginal supply costs are not included in the figure, a grade of 10 should not be selected
Improvements to attain higher data grading for "Variable Production Cost" component		to qualify for 2 Gather available records, institute new procedures to regularly collect and audit basic cost data and most important operations functions	to qualify for 4 Implement an electronic cost accounting system structured according to accounting standards for water utilities		to qualify for 6 Formalize process for regular internal audits of production costs Assess whether additional costs (liability, residuals management, equipment wear, impending infrastructure expansion) should be included to calculate a more representative variable production cost		to qualify for 8 Formalize the accounting process to include direct cost components (power, treatment) as well as indirect cost components (liability, residuals management, etc) Arrange to conduct audits by a knowledgable third-party at least once every three years		to qualify for 10 Standardize the process to conduct a third-party financial audit by a CPA on an annual basis		to maintain 10 Maintain program, stay abreast of expenses subject to erratic cost changes and budget/track costs proactively

Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, Lp, for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration Lp = 0 since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where Lp is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building , where Lp is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the Lp will vary notably in a community of different structures, therefore the average Lp value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

Click for more information

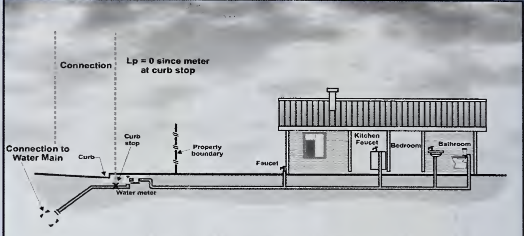


Figure 1

Typical house connection: Meter at curb stop
Not to scale

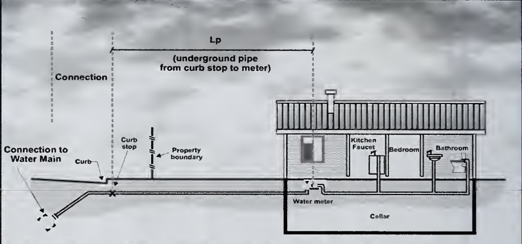


Figure 2

Typical house connection: Meter inside property
Not to scale

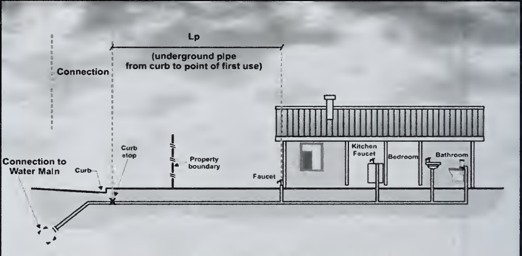


Figure 3

Typical house connection: Unmetered
Not to scale

AWWA Free Water Audit Software: Definitions

WAS v5.0

Item Name	Description
Apparent Losses Find	= unauthorized consumption + customer metering inaccuracies + systematic data handling errors Apparent Losses include all types of inaccuracies associated with customer metering (worn meters as well as improperly sized meters or wrong type of meter for the water usage profile) as well as systematic data handling errors (meter reading, billing, archiving and reporting), plus unauthorized consumption (theft or illegal use). NOTE: Over-estimation of Apparent Losses results in under-estimation of Real Losses. Under-estimation of Apparent Losses results in over-estimation of Real Losses.
AUTHORIZED CONSUMPTION Find	= billed water exported + billed metered + billed unmetered + unbilled metered + unbilled unmetered consumption The volume of metered and/or unmetered water taken by registered customers, the water utility's own uses, and uses of others who are implicitly or explicitly authorized to do so by the water utility; for residential, commercial, industrial and public-minded purposes. Typical retail customers' consumption is tabulated usually from established customer accounts as billed metered consumption, or - for unmetered customers - billed unmetered consumption. These types of consumption, along with billed water exported, provide revenue potential for the water utility. **Be certain to tabulate the water exported volume as a separate component and do not "double-count" it by including in the billed metered consumption component as well as the water exported component.** Unbilled authorized consumption occurs typically in non-account uses, including water for fire fighting and training, flushing of water mains and sewers, street cleaning, watering of municipal gardens, public fountains, or similar public-minded uses. Occasionally these uses may be metered and billed (or charged a flat fee), but usually they are unmetered and unbilled. In the latter case, the water auditor may use a default value to estimate this quantity, or implement procedures for the reliable quantification of these uses. This starts with documenting usage events as they occur and estimating the amount of water used in each event (See Unbilled unmetered consumption)
View Service Connection Diagram **Average length of customer service line** Find	This is the average length of customer service line, Lp, that is owned and maintained by the customer; from the point of ownership transfer to the customer water meter, or building line (if unmetered). The quantity is one of the data inputs for the calculation of Unavoidable Annual Real Losses (UARL), which serves as the denominator of the performance indicator: Infrastructure Leakage Index (ILI). The value of Lp is multiplied by the number of customer service connections to obtain a total length of customer owned piping in the system. The purpose of this parameter is to account for the unmetered service line infrastructure that is the responsibility of the customer for arranging repairs of leaks that occur on their lines. In many cases leak repairs arranged by customers take longer to be executed than leak repairs arranged by the water utility on utility-maintained piping. Leaks run longer - and lose more water - on customer-owned service piping than utility owned piping. If the customer water meter exists near the ownership transfer point (usually the curb stop located between the water main and the customer premises) this distance is zero because the meter and transfer point are the same. This is the often encountered configuration of customer water meters located in an underground meter box or "pit" outside of the customer's building. The Free Water Audit Software asks a "Yes/No" question about the meter at this location. If the auditor selects "Yes" then this distance is set to zero and the data grading score for this component is set to 10. If water meters are typically located inside the customer premise/building, or properties are unmetered, it is up to the water auditor to estimate a system-wide average Lp length based upon the various customer land parcel sizes and building locations in the service area. Lp will be a shorter length in areas of high density housing, and a longer length in areas of low density housing and varied commercial and industrial buildings. General parcel demographics should be employed to obtain a composite average Lp length for the entire system. Refer to the "Service Connection Diagram" worksheet for a depiction of the service line/metering configurations that typically exist in water utilities. This worksheet gives guidance on the determination of the Average Length, Lp, for each configuration.
Average operating pressure Find	This is the average pressure in the distribution system that is the subject of the water audit. Many water utilities have a calibrated hydraulic model of their water distribution system. For these utilities, the hydraulic model can be utilized to obtain a very accurate quantity of average pressure. In the absence of a hydraulic model, the average pressure may be approximated by obtaining readings of static water pressure from a representative sample of fire hydrants or other system access points evenly located across the system. A weighted average of the pressure can be assembled, but be sure to take into account the elevation of the fire hydrants, which typically exist several feet higher than the level of buried water pipelines. If the water utility is compiling the water audit for the first time, the average pressure can be approximated, but with a low data grading. In subsequent years of auditing, effort should be made to improve the accuracy of the average pressure quantity. This will then qualify the value for a higher data grading.
Billed Authorized Consumption	All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Billed metered consumption Find	All metered consumption which is billed to retail customers, including all groups of customers such as domestic, commercial, industrial or institutional. **It does NOT include water supplied to neighboring utilities (water exported) which is metered and billed. Be sure to subtract any consumption for exported water sales that may be included in these billing roles. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.** The metered consumption data can be taken directly from billing records for the water audit period. The accuracy of yearly metered consumption data can be refined by including an adjustment to account for customer meter reading lag time since not all customer meters are read on the same day of the meter reading period. However additional analysis is necessary to determine the lag time adjustment value, which may or may not be significant
Billed unmetered consumption Find	All billed consumption which is calculated based on estimates or norms from water usage sites that have been determined by utility policy to be left unmetered. This is typically a very small component in systems that maintain a policy to meter their customer population. However, this quantity can be the key consumption component in utilities that have not adopted a universal metering policy. **This component should NOT include any water that is supplied to neighboring utilities (water exported) which is unmetered but billed. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.**

Item Name	Description
Customer metering inaccuracies Find	Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear or from the improper application of the meter; i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger. The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for <u>all</u> customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testing activities, he or she can calculate their own loss volumes, and this volume may be entered directly. Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degree of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.
Customer retail unit cost Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, storm water or biosolids processing, <u>but only if</u> these charges are based upon the volume of potable water consumed. For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer. Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet, or $/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, $.
Infrastructure Leakage Index (ILI) Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.
Length of mains Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as: Length of Mains, miles = (total pipeline length, miles) + [{(average fire hydrant lead length, ft) x (number of fire hydrants)} / 5,280 ft/mile] or Length of Mains, kilometres = (total pipeline length, kilometres) + [{(average fire hydrant lead length, metres) x (number of fire hydrants)} / 1,000 metres/kilometre]
NON-REVENUE WATER Find	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.
Number of <u>active AND inactive</u> service connections Find	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). **Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hyrants should be included in the "Length of mains" parameter.**
Real Losses Find	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density Find	=number of customer service connections / length of mains

Item Name	Description
Systematic data handling errors Find	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports **Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.** Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex. monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. <u>Data Transfer Errors</u> result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors. Apparent losses also occur from <u>Data Analysis Errors</u> in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor <u>has</u> investigated the billing system and its controls, and <u>has</u> well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. <u>Note:</u> negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water
Unauthorized consumption Find	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL) Find	UARL (gallons)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on deterring the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, <u>in gallons:</u> (Lm x 32) + Nc < 3000 or P <35psi <u>in litres:</u> (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true

Item Name	Description
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.
Unbilled metered consumption Find	Metered consumption which is authorized by the water utility, but, for any reason, is deemed by utility policy to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does not include water supplied to neighboring utilities (water exported) which may be metered but not billed.**
Unbilled unmetered consumption Find	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility has carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: 1 — Convert From... Million Gallons (US) = Converts to..... 3.06888329 Acre-feet (conversion factor = 3.06888328973723)
Use of Option Buttons	To use the default percent value choose this button — To enter a value choose this button and enter the value in the cell to the right Pcnt: 1.25% ◉ ○ Value: **NOTE:** For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item, a grading value of 5 is automatically applied (however, this grade will not be displayed).
Variable production cost (applied to Real Losses) Find	The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources Find	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.

Item Name	Description
olume from own ources: Master neter and supply error adjustment Find	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow) Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should <u>not</u> be entered. Enter a negative percentage or value for metered data under-registration or enter a positive percentage or value for metered data over-registration.
Water exported Find	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**
Water exported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data Thus, a value of zero should <u>not</u> be entered Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported Find	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should <u>not</u> be entered Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES Find	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

AWWA Free Water Audit Software:
Determining Water Loss Standing

WAS v5.0

Water Audit Report for:	San Francisco Public Utilities Commission - Wholesale	
Reporting Year:	2015	7/2014 - 6/2015
Data Validity Score:	83	

Water Loss Control Planning Guide

Functional Focus Area	Water Audit Data Validity Level / Score				
	Level I (0-25)	**Level II** (26-50)	**Level III** (51-70)	**Level IV** (71-90)	**Level V** (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs. Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or Automatic Meter Reading (AMR) system.	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.

Once data have been entered into the Reporting Worksheet, the performance indicators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

AWWA Free Water Audit Software: Acknowledgements

AWWA Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

DEVELOPED BY:

Andrew Chastain-Howley, PG, MCSM. Black & Veatch*
Will J. Jernigan, P.E. Cavanaugh & Associates, P.A.
George Kunkel, P.E. Philadelphia Water Department
Alain Lalonde, P.Eng. Master Meter Canada Inc.
Ralph Y. McCord, P.E. Louisville Water Company
David A. Sayers Delaware River Basin Commission
Brian M. Skeens, P.E. CH2M HILL
Reinhard Sturm Water Systems Optimization, Inc.
John H. Van Arsdel M.E. Simpson Company, Inc.

REFERENCES:

- *Alegre, H., Himer, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272*
- *Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65*
- *AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009*
- *Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.*

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.

This page intentionally left blank.

APPENDIX J

Estimation of Sunol Population with DWR Population Tool

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

WUEdata - San Francisco City And County

Please print this page to a PDF and include as part of your UWMP submittal.

Confirmation Information

Generated By	Water Supplier Name	Confirmation #	Generated On
Winola Cheong	San Francisco City And County	8639310538	1/19/2016 9:11:45 PM

Boundary Information

Census Year	Boundary Filename	Internal Boundary ID
1990	Sunol_11Jan2016.kml	457
2000	Sunol_11Jan2016.kml	457
2010	Sunol_11Jan2016.kml	457

Baseline Period Ranges

10 to 15-year baseline period

2008 total water deliveries[1]:	425311	Hundred Cubic Feet (CCF)
2008 total volume of delivered recycled water[1]:	0	Hundred Cubic Feet (CCF)
2008 recycled water as a percent of total deliveries:	0.00%	
Number of years in baseline period[2]:	10	
Year beginning baseline period range:	2001	
Year ending baseline period range[3]:	2010	

5-year baseline period

Year beginning baseline period range:	2006
Year ending baseline period range[4]:	2010

[1] The selected units of measure must apply to both the 2008 total water deliveries and the 2008 total volume of delivered recycled water. If the water supplier records use different units of measure for these volumes, the user must make a conversion so that both volumes are in the same units of measure.

[2] If the 2008 recycled water percent is less than 10 percent, then the first baseline period is a continuous 10-year period. If the amount of recycled water delivered in 2008 is 10 percent or greater, the first baseline period is a continuous 10- to 15-year period.

[3] The ending year must be between December 31, 2004 and December 31, 2010.

[4] The ending year must be between December 31, 2007 and December 31, 2010.

Persons per Connection

Year	Census Block Level Total Population	Number of Connections *	Persons per Connection
1990	198	69	2.87
1991			3.06
1992			3.25
1993			3.43
1994			3.62
1995			3.81
1996			4.00
1997			4.19
1998			4.37
1999			4.56
2000	328	69	4.75
2001			4.50
2002			4.26
2003			4.01
2004			3.77
2005			3.52
2006			3.28
2007			3.04
2008			2.79
2009			2.54
2010	237	103	2.30
2015	-	-	1.08

** Number of Connections may be either All Residential Connections (Single Family and Multi-Family combined) or All Service Connections. This will depend on the data available from the water supplier's records, but must remain consistent throughout the table.*

Population Using Persons-Per-Connection				
Year		Number of Connections *	Persons per Connection	Total Population
10 to 15 Year Baseline Population Calculations				
Year 1	2001	63	4.50	284
Year 2	2002	67	4.26	285
Year 3	2003	71	4.01	285
Year 4	2004	75	3.77	283
Year 5	2005	79	3.52	278
Year 6	2006	83	3.28	272
Year 7	2007	89	3.04	270
Year 8	2008	93	2.79	259
Year 9	2009	94	2.54	239
Year 10	2010	103	2.30	237
5 Year Baseline Population Calculations				
Year 1	2006	83	3.28	272
Year 2	2007	89	3.04	270
Year 3	2008	93	2.79	259
Year 4	2009	94	2.54	239
Year 5	2010	103	2.30	237
2015 Compliance Year Population Calculations				
2015		112	1.08	121

** Number of Connections may be either All Residential Connections (Single Family and Multi-Family combined) or All Service Connections. This will depend on the data available from the water supplier's records, but must remain consistent throughout the table.*

Hide Print Confirmation

<u>Revision to 2015 population estimate per DWR consultation:</u>

Upon completion of the DWR population tool, it was found that the estimated population for the year 2015 was much lower than expected. Based on the number of service connections and SFPUC staff understanding of local population density, customer population in the Sunol service area should not have changed significantly. After consultation with DWR staff, the SFPUC was directed to use the same persons-per-connection number that was estimated for the year 2010 and apply it to the year 2015. The 2015 population estimate was therefore revised to be 112x2.3=258.

APPENDIX K

Summary of San Francisco's Response to 1987-92 Drought Experience

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

Summary of San Francisco's Response to 1987-92 Drought Experience

Background:

The 1987-92 six year drought provides an example of how the near-term drought management process works in times when the operational capabilities of Hetch Hetchy and other water supplies available to the SFPUC are taxed to a point that forces drastic actions to avoid running out of water. By the sixth year of that drought period, many of the programs and actions identified in San Francisco's current Retail Water Shortage Allocation Plan (adopted in December 2001) had been implemented. The following describes some of the major actions that occurred.

Demand Reductions:

The extended drought forced San Francisco to adopt a mandatory rationing program, enforced by stiff excess use charges and the threat of shut-off for continued violations of water use prohibitions. Mandatory rationing was in effect May of 1988 through May of 1989, re-instituted in May of 1990, and continued until March of 1993. A Water Shortage Emergency Resolution was passed by the SFPUC on April 28, 1988 declaring these rationing periods (Resolution No. 88-0155). A copy of this resolution can be found at the end of this appendix.

The SFPUC's water rationing program was one of the toughest in the state and the most stringent imposed by any major urban water supply agency. Although the specifics of the program varied over time, the basic outline of the mandatory rationing program was to achieve a 25 percent reduction to 1987 (pre-drought) consumption (system-wide), with water allocations set on an account-by-account basis.

To provide a strong incentive for customers to use no more water than their allotment, the SFPUC adopted a rate structure that incorporated excess use charges. Any customer that used less water than its allotment was charged the normal rate per unit of water consumption, while any customer who used more than its allotment was charged a multiple of the normal rate for every unit of consumption above its allotment. As of January 1, 1992 (the last year of the rationing program), the rate structure shown in the table below applied to SFPUC customers.

Excess Use Charges	
If Water Consumption Is (Over Allotment)	Excess Use Charge Will Be (Times Normal Rate)
Up to 10%	2
10.01 - 20%	8
20.01% or over	10

In the event that water was used in excess of the customer's specified allotment, the SFPUC could, after one written warning, install a flow restrictor on the customer's service line. The charge to install and remove the restricting device is shown in the table below. If a customer continued to consume water in excess of its allotment, the SFPUC had the authority to discontinue the customer's water service and require the customer to bear the cost for the re-connection of water service.

Fee For Installing Flow Restricting Devices	
Meter Size	Installation/Removal Cost
to 1"	$95
1" to 2"	$149
3" and larger	Actual cost

In addition to pricing disincentives for excess water use, numerous water use restrictions were adopted and enforced. San Francisco retail customers were required to comply with the following water use prohibitions and restrictions:

- Water waste, including but not limited to, any flooding or runoff into the street or gutters, was prohibited.
- Hoses could not be used to clean sidewalks, driveways, patios, plazas, homes, businesses, parking lots, roofs, awnings or other hard surfaces areas.
- Hoses used for any purpose had to have positive shutoff valves.
- Restaurants served water to customers only upon request.
- Potable water was not to be used to clean, fill or maintain levels in decorative fountains.
- Use of additional water was not allowed for new landscaping or expansion of existing facilities unless low water use landscaping designs and irrigation systems were employed.
- Water service connections for new construction were granted only if water saving fixtures or devices were incorporated into the plumbing system.
- Use of potable water for consolidation of backfill, dust control or other non-essential construction purposes was prohibited.
- Irrigation of lawns, play fields, parks, golf courses, cemeteries, and landscaping of any type with potable water would be reduced by at least the amount specified for outside use in the adopted rationing plan.
- Verified water waste as determined by the Water Department would serve as prima facie evidence that the allocation assigned to the water account is excessive; therefore, the allocation was subject to review and possible reduction, including termination of service.
- Water used for all cooling purposes was to be recycled.
- The use of groundwater and/or reclaimed water for irrigation of golf courses, median strips, and similar turf areas was strongly encouraged.
- The use of groundwater and/or reclaimed water for street sweepers/washers was strongly encouraged.

In addition to water use prohibitions and directives specifically responsive to the drought, the SFPUC coincidentally was implementing long-term conservation programs, which also lowered water demands during the drought period (refer to the Demand Management discussion). Following the drought, several of the measures described above were adopted by San Francisco into permanent, on-going programs.

Water Management:

In addition to effecting reductions to water demands, the SFPUC also employed water management activities to control the severity of water shortages to its customers.

During the drought and for the first time in history, the SFPUC utilized a Delta supply within its system. The SFPUC imported water from the Delta through use of State Water Project South Bay Aqueduct facilities. The sources of water transferred included transfers via the California Emergency Water Bank, Placer County and the Modesto Irrigation District. The waters were diverted from the South Bay Aqueduct into the SFPUC's San Antonio Reservoir and then treated and integrated into SFPUC's water distribution system.

The amount of water actually delivered to the SFPUC was constrained due to numerous factors including the lack of willing sellers, allocation procedures, lack of priority in use of the State transmission facilities, storage constraints in San Antonio Reservoir, and water treatment constraints within the SFPUC's system. The total water that was imported into the SFPUC's system amounted to a maximum of approximately 31,000 acre-feet in one year, and in total for the drought period amounted to 59,000 acre-feet.

The importation of additional water into the SFPUC's system allowed the continuation of a 25 percent system-wide rationing program as compared to a potentially higher level of rationing had the transfers not occurred.

System Response and Effects:

The system-wide goal of reducing water use by 25 percent was achieved. However, the reduction was not accomplished without cost or hardship.

To achieve its annual 25 percent system-wide rationing goal, the SFPUC targeted a reduction of indoor consumption by 10 percent and outdoor consumption by 60 percent.

Due to the nature of the allocation formula for water allotments and the level of system-wide reduction goals, instances occurred where individual users or wholesale water customers were burdened with up to twice the system-wide average in delivery reductions.

Some of the costs incurred by individuals, property owners and renters include:

- The cost of installing low-flow toilets, retrofit kits for toilets and showerheads, and special low-water use landscaping and irrigation systems
- The financial losses resulting from loss of lawns, plants and trees due to the 60 percent reduction in water available for irrigation
- The cost of excess use charges ($12,300,000 in excess use charges was billed to retail accounts in fiscal year 1991-92 alone)

The ability of SFPUC's retail customers to achieve a 25 percent reduction in the future is highly unlikely due to the "hardening" of water demands that occurred during and subsequent to the drought. The rationing programs implemented by San Francisco during the 1987-92 drought were measured by comparison to calendar year 1987 water deliveries, i.e., pre-drought conditions.

During the 1987-92 drought San Francisco's retail and wholesale water customers implemented numerous conservation measures that have led to permanent per capita water usage savings. San Francisco's current

water demand is likely hardened as compared to the 1987 level of water demand. This situation leads to a conclusion that comparable rationing goals (e.g., up to 25 percent reduction) would be more difficult to achieve since the drought, and would require measures in excess of those implemented during the 1987-92 drought to achieve a comparable percentage of delivery reduction.

As the level of rationing increases, the economic and societal impacts become more severe. The SFPUC has first hand experience in attempting to employ rationing to levels, which are intolerable to citizens and businesses.

In 1991, water storage had deteriorated and the SFPUC was forced to immediately adopt a 45 percent system-wide rationing plan. It was proposed the reduction would be achieved through a 33 percent reduction to inside water use and a 90 percent reduction to outside water use.

San Francisco's plan for meeting its rationing goal included the following minimum and maximum criteria:

- *Maximum Allocation for Single and Multi-family Residences.* No single-family residence shall receive an allocation of more than 300 gallons per day: no multi-family residence shall receive an allocation of more than 150 gallons per day times the number of living units in the building.

- *Minimum Allocation for All Residential Accounts.* A minimum of 50 gallons per day per documented resident will be allowed. However, a minimum allocation will not be approved to increase an allocation above current usage absent a documented change in circumstances.

- *Irrigation Services.* Accounts classified for irrigation only will be reduced by 90 percent.

- *Commercial/Industrial Allocations.* Commercial and industrial allocations will be reduced by 32 percent. Hospitals and other health care facilities may be subject to lesser restrictions subject to verification that all conservation measures are in place; such approval shall require an on-site conservation inspection.

- *Allocations for New Accounts.* Initial allocations will be established at 50 gallons per day. These allocations will be re-evaluated after customers have installed retrofit kits provided by the San Francisco Water Department. After verification of installation, allocations will be calculated on the basis of the number of documented residents within a household, or, in the case of commercial or industrial customers, on the basis of business data supplied to the Department.

Additional water use restrictions and prohibitions were enforced:

- The washing of all automobiles, motorcycles, RVS, trucks, transit vehicles, trailers, boats, trains and airplanes was prohibited outside of a commercial washing facility.

- Exceptions to the above use restriction were windows on all vehicles and such commercial or safety vehicles requiring cleaning for health and safety reasons.

- Water used for all cooling purposes or for commercial car washes had to be recycled.

- The use of potable water on golf courses was limited to the irrigation of putting greens. The use of groundwater and reclaimed water was permitted when approved by the Department of Health.

- The filling of new swimming pools, spas, hot tubs or the draining and refilling of existing pools, etc., was prohibited; topping off was allowed to the extent that the designated allocation was not exceeded.

- The irrigation of median strips with potable water was prohibited. The use of groundwater and reclaimed water was permitted when approved by the Department of Health.

- The use of potable water for street sweepers/washers was prohibited. The use of groundwater and reclaimed water was permitted when approved by the Department of Health.

Public and commercial response to 45 percent rationing was overwhelmingly negative. During the first weeks after notification of the program, SFPUC received over 2,000 appeal letters per day. In the month before rationing was returned to 25 percent, 19,000 appeals, 12,000 telephone calls, and 1,500 walk-in complaints occurred.

Both the allocation levels and new prohibitions required to meet this level of rationing would have had a devastating effect on commercial enterprises. Some water uses would have simply been prohibited. Simply put, rationing had been taken to a level that was considered intolerable to citizens and had become economically disastrous.

CITY AND COUNTY OF SAN FRANCISCO

RESOLUTION No. 88-0155

WHEREAS, The San Francisco Water Department obtains water from the reservoirs operated by the Hetch Hetchy Water and Power and from local Bay Area reservoirs; and

WHEREAS, Due to critically low supplies of water within the reservoirs and anticipated low levels of inflow into the reservoirs, such that unless consumption is decreased there may be insufficient water supplies for human consumption, sanitation and fire protection; and

WHEREAS, Decreases in water consumption may be accomplished by reducing allocations to the Water Department's wholesale customers and by imposing water use restrictions on the Water Department's retail customers, as set forth in the Water Rationing Rules and Regulations, issued on April 21, 1988 and attached hereto as Water Rationing Rules and Regulations; and

WHEREAS, This Commission recognizes the need to declare a Water Shortage Emergency (Water Code Sec. 350, et. seq.) due to critically low water supplies now available, and the need for a reduction in water use by the San Francisco Water Department's Suburban Wholesale Customers; and

WHEREAS, This Commission recognizes the need to adopt a Water Conservation Program (Water Code Sec. 375, et. seq.) due to the critically low water supplies now available, and the need for a reduction in water use by the San Francisco Water Department's retail customers; and

WHEREAS, The City of San Jose is, by Resolution 85-0256, a temporary and interruptible wholesale customer of the Water Department, and the Settlement Agreement and Master Water Sales Contract between the City and County of San Francisco and certain Suburban Purchasers in San Mateo County, Santa Clara County and Alameda County (Settlement Agreement) requires action by the Commission to interrupt service to the City of San Jose (Section 8.17); and

WHEREAS, The City of Santa Clara is, by Resolution 85-0257, a temporary and interruptible wholesale customer of the Water Department, and the Settlement Agreement requires action by the Commission to interrupt service to the City of Santa Clara (Section 8.17); and

WHEREAS, Additional funding in the amount of $648,780 for FY 1988/89 has been identified by the Water Department for implementation of a mandatory water rationing program; and

WHEREAS, on April 21, 1988, the Water Department submitted to this Commission a Water Conservation Program; and

WHEREAS, The Conservation Program shall cease to exist in whole or in part at such time as the Commission finds that the supply of water available to the Water Department's service area has been replenished or augmented so that there are sufficient supplies to meet the needs of the Water Department's customers without the continued implementation of these measures; and

UU19I

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of APRIL 22 1988

Romaine A. Boldridge

Secretary, Public Utilities Commission

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO

RESOLUTION No. 88-0155

WHEREAS, The recommended Water Conservation Program has received wide-spread public distribution; and

WHEREAS, Members of the public have been given an opportunity to, and have expressed their views on the recommended Water Conservation Program in a public hearing; now, therefore be it

RESOLVED, That this Commission declares a Water Shortage Emergency; and

BE IT FURTHER RESOLVED, That this Commission adopts a Water Conservation Program; and

BE IT FURTHER RESOLVED, That this Commission approves the Water Conservation Program dated April 21, 1988 as amended April 28, 1988, and directs that it be placed in force on May 1, 1988; and

BE IT FURTHER RESOLVED, That it is not the Commission's intention to interrupt water service to the cities of San Jose and/or Santa Clara; however, pursuant to its obligation under the Settlement Agreement and Master Water Sales Contract this Commission authorizes the General Manager of the Water Department to interrupt water service to the cities of San Jose and/or Santa Clara if necessary to achieve the required water saving, however, prior to actual interruption of service to either the City of San Jose or Santa Clara, the General Manager of the Water Department shall report to the Commission the need for interruption and receive affirmation from the Commission prior to institution of the interruption; and the Commission further directs the General Manager of the Water Department to mitigate the effect of the interruptions to the extent possible and consistent with the needs of San Francisco's permanent customers; and

BE IT FURTHER RESOLVED, That this Commission hereby authorizes the additional budget needs to be added to the Water Department's Conservation Programmatic Budget, thus amending the Water Department's budget request for FY 1988/89; and

BE IT FURTHER RESOLVED, That this Commission hereby designates Tuesday, May 24, 1988 as the date for a public hearing by the Public Utilities Commission for considering proposals for rate increases and additional charges for water service and water supplied by the San Francisco Water Department to retail customers; and

BE IT FURTHER RESOLVED, That this Commission hereby designates Tuesday, May 24, 1988 as the date for a public hearing by the Public Utilities Commission for considering proposals for rate structure adjustments for water service and water supplied by the San Francisco Water Department to wholesale customers; and

BE IT FURTHER RESOLVED, That the revenue requirements and an analysis of the rate increases, rate structure adjustments and additional charges be made available for public inspection and review beginning Monday, May 16, 1988 in Room 287, City Hall, San Francisco.

0019f

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission

at its meeting of APRIL 28 1988

Romaine A. Boldridge

Secretary, Public Utilities Commission

This page intentionally left blank.

APPENDIX L

Retail Water Shortage Allocation Plan

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

RETAIL WATER SHORTAGE ALLOCATION PLAN

December 11, 2001

Table of Contents

I. Introduction

A. Purpose and Need for Retail Water Shortage Allocation Plan

The intent of the Retail Water Shortage Allocation Plan (Plan) is to provide the San Francisco Public Utilities Commission (SFPUC) with a guidance tool to be used for allocating water amongst the City and County San Francisco retail customers ("retail customers") in the event of a water shortage due to drought. Additionally, the Plan provides retail customers with a framework for understanding how the SFPUC intends to allocate water resources during times of water shortage due to drought. The expectation is that this Plan can help retail customers better anticipate how their individual water supply will be affected during a drought.

The need for this Plan has come about as a result of a series of actions and experiences including the SFPUC's adoption of the Interim Water Shortage Allocation Plan and the drought of 1987-1992. At the time of the 1987-1992 drought, the SFPUC, in the absence of a drought plan, reacted to the drought by adopting a short-term approach for allocating water resources amongst both retail and wholesale customers. This Plan in combination with the Interim Water Shortage Allocation Plan puts in place a long-term plan for responding to levels of water shortage due drought. The following sections describe these actions and experiences in more detail.

1. Interim Water Shortage Allocation Plan

In October 2000, the SFPUC adopted an Interim Water Shortage Allocation Plan (IWSAP) that provides a method and process by which the SFPUC intends to allocate water resources between its collective retail customers and wholesale customers during system-wide water shortages of up to 20 percent resulting from drought. The IWSAP was subsequently adopted by all 29 wholesale customers between October 2000 and June 2001 thereby officially activating the allocation method and process outlined in the IWASP.

The allocation method adopted in the IWSAP relies on a percentage decrease of inside and outside water use and provides a notification schedule for informing customers of an upcoming drought. The IWSAP also outlines a structure for water transfers between the retail and wholesale customers. Finally, the IWSAP identifies an enforcement process for ensuring that the allocations are adhered to through the application of excess use charges.

This Retail Plan is consistent with the IWSAP in its methodology, schedule and enforcement process.

2. Past Drought Experience

The SFPUC, along with the entire State of California, experienced a significant drought from 1987 to 1992. During this time the SFPUC experienced system-wide shortages of 25 to nearly 45 percent. In response to the drought, the SFPUC instituted mandatory rationing which required retail customers to reduce indoor and outdoor consumption based on specified allocations for those use types. As the drought progressed, SFPUC

retail customers were required to reduce total consumption by 14 percent, up to approximately 32 percent. If customers consumed beyond their allotted amount they were faced with excess use charges. For the most part, customers were able to reduce their indoor use through installation of water-conserving devices such as low-flow toilets, showerheads and faucet aerators.

The Customer Service Bureau of the SFPUC created a short-term rationing unit to implement the drought program. The rationing unit's primary responsibility was to enforce mandatory rationing and manage the allocation and appeal process. Throughout the drought, the rationing unit received 131,000 requests for modified allocations. In general, allocations were modified on the basis of increased occupancy, medical exemptions, allowances for past conservation, increased business, and other miscellaneous reasons. Modifications were based on a per capita allotment.

The rationing unit also performed audits on those customers who consumed water beyond their allocations. This was done in an effort to identify the presence of leaks or other system failures that resulted in excess use.

B. Long-term Conservation Programs and Existing Demand Reduction Policies/Ordinances

1. Long-term Conservation Programs

In 1986, prior to the 1987-1992 drought, the SFPUC established a long-term conservation program. A conservation administrator was hired to implement the program. The programs, at that time, included public information and education; a conservation device retrofit program; landscape water audit program; and a low-use landscaping program. During the drought the long-term conservation program continued.

In 1991, the SFPUC elevated its long-term conservation program when it became a signatory to the *Memorandum of Understanding Regarding Urban Water Conservation in California.* This MOU outlined water-conserving Best Management Practices (BMPs) that all signatories agreed to implement. Today's BMPs include:

- Interior and Exterior Water Audits and Incentive for Single Family Residential and Multi-family Residential Customers
- Residential Plumbing Retrofit
- System Water Audits, Leak Detection and Repair
- Metering with Commodity rates for all New Connections and Retrofit of Existing Connections
- Large Landscape Conservation Programs and Incentives
- Horizontal Axis Washer Rebate Programs
- Public Information
- School Education Programs
- Commercial, Industrial and Institutional Water Conservation
- Wholesale Agency Assistance Programs
- Conservation Pricing
- Conservation Coordinator
- Water Waste Prohibition

- Residential Ultra Low Flush Toilet Replacement Programs

Through the implementation of the long-term conservation program, the SFPUC retail residential customers have reduced their per capita per day (pcpd) demand by 12 gallons. That is, prior to the 1987-1992 drought per capita residential demand was at 73 gallons per capita per day (gpcpd) while current demand is at 61 gpcd. Approximately 95 percent of SFPUC retail customers have signed affidavits confirming that they have installed water-conserving devices in their homes to eliminate water waste. Such devices include low flush toilets, faucet aerators and low flow showerheads.

2. Existing Demand Reduction Policies/Ordinances

In addition to the long-term conservation programs in place, the SFPUC and Board of Supervisors have implemented several demand reduction policies and ordinances that encourage the reduction of potable water use. These policies and ordinances range from requiring installation of conservation devices at the time of residential resale to development of groundwater and recycled water sources. The following summarizes measures adopted through 2001.

Water Conservation Ordinances

Ordinance 392-90: Water Conservation Fixtures in New and Renovated Buildings [1]. This ordinance changed San Francisco plumbing codes to require all new buildings (and all buildings in which the water drainage system is substantially altered modified or renovated) to install/retrofit toilets and urinals with fixtures using no more than 1.6 gallons per flush and 1 gallon per flush, respectively.

Ordinance 185-91 and *Ordinance 346-91: Plumbing Fixture Retrofit in Multi-family Residential Buildings and Single-Family Residential Buildings*[2]. Collectively these ordinances require water conservation device retrofits within multi-family and single-family residential buildings upon sale, transfer of title, or major improvement to a dwelling. The ordinance also required all applicable fixtures within multi-family residential units to be retrofitted within three years subsequent to the effective date of the ordinances (by the end of 1994).

Retrofit requirements include:

- Installation of Showerheads with a capacity not exceeding 2.5 gallons per minute;
- Installation of aerators attached to sinks and basins where possible; and
- Installation of flush reducers, flow restrictors, volume reducers, or toilets with a capacity not exceeding 3.5 gallons per flush.

Ordinance 359-91: Plumbing Fixture Retrofit of Commercial Buildings, including Tourist Hotels and Motels[3]. This ordinance required the same plumbing retrofit requirements for commercial buildings, including tourist hotels and motels as was required for single and multi-family residential buildings. Compliance of this ordinance was also required by 1994.

---

[1] San Francisco Plumbing Code sections 905 and 1001.1

[2] San Francisco Housing Code, Chapter 12A, Section 12A01-12A14

[3] San Francisco Building Code, Chapter 53B, Sections 53B01-53B15

Ordinance 92-91(as amended by Ordinance 192-00): Water Use for Landscaping in New Developments[4]. This ordinance requires particular water-conserving landscape strategies be employed for any new commercial, governmental or residential (two or more units) building on a lot exceeding 3,500 square feet or with a landscaping area of more than 1,000 square feet. The specific requirements of the ordinance include:

- Total area devoted to turf grass; decorative water use and water intensive planting must be limited to 15% of the parcel area. The limitation does not apply to children's play areas, public recreation areas or other such areas;
- Strips of turf less than 8 feet wide are prohibited;
- Water intensive plants must be grouped together and must be irrigated on a separate cycle from turf grass;
- Slopes exceeding 10% adjacent to the hardscape cannot consist of turf grass;
- All large areas must have separately metered irrigation systems;
- Valves and circuits shall be separated based on water use and must be set to operate between 5 p.m. and 10 a.m.; and
- A soil analysis must be done on the soil used for the landscape. A report specifying how the soil deficiencies will be meet must accompany the application for the meter.

Ordinance 148-99: Plumbing Retrofit of Municipal Buildings[5]. This ordinance requires all municipal buildings to replace their water-inefficient toilets with 1.6 gallons per flush toilets and showerheads with 1.5 gallons per minute showerheads by June 6, 2005.

Recycled Water Ordinances

Ordinances 390-91 and *391-91(as amended by Ordinance 393-94): Mandatory Use of Reclaimed Water*[6]. These ordinances require the development of a Recycled Water Master Plan including the designation of recycled (or reclaimed) water use areas within San Francisco and requires the installation of dual plumbing systems within the recycled water use areas for the following situations:

- New or remodeled buildings and all subdivisions (except condominium conversions) with a total area of 40,000 square feet or more; and
- New and existing irrigated areas of 1,000 square feet or more.

Ordinance 175-91: Mandatory Use of Non-Potable Water for Soil Compaction and Dust Control[7]. This ordinance requires the use of non-potable water for soil compaction and dust control during construction and demolition projects.

---

[4] San Francisco Administrative Code, Chapter 63, 63-63.11

[5] San Francisco Administrative Code, Chapter 82, Section 4.

[6] San Francisco Public Works Code, Article 22, Sections 1200-1210

[7] San Francisco Public Works Code, Article 21, Sections 1100-1107

Water Waste Prohibitions

The Customer Service Bureau currently enforces several water waste prohibitions through a complaint/inspection process. The following prohibitions are subject to that process:

- Water waste, including but not limited to, any flooding or runoff into the street or gutters is prohibited;
- Hoses used for any purpose must have positive shut-off valves;
- Restaurants shall serve water to customers only upon request; and
- Water used for all cooling purposes and commercial car washes must be recycled.

3. Relationship between Future Demand Reductions and Existing Long-term Conservation Programs

The SFPUC retail customers are facing a hardened demand as a result of long-term conservation programs and installation of water-conserving devices during the 1987-92 drought. As a result of these factors, residential demand has been reduced by 12 gallons per capita per day (gpcpd) since pre-drought demand levels. In addition, approximately 95 percent of residential customers have signed affidavits attesting to the fact that they have installed low-flush toilets, faucet aerators and low-flow showerheads. Furthermore, the SFPUC's consistent implementation of BMPs for water conservation, as identified above, has resulted in hardened demand for commercial, industrial and institutional customers.

This hardened demand means that reducing demand during future droughts will be challenging. As mentioned previously, during the 1987-92 drought there was an opportunity to reduce demand by installing low-flush toilets, faucet aerators and low-flow showerheads. That opportunity has been significantly reduced. This means that during the next drought demand reduction will most likely come from changing the frequency in which water-consuming devices are used. For example, reducing the number of times the toilet is flushed or running the washing machine less frequently.

Despite the challenge, there is a need for the SFPUC to adopt a plan to be implemented during droughts that will result in reducing water delivery from the SFPUC reservoir system. This includes adopting a water shortage allocation plan, the principal objective of this Retail Plan.

C. Components of the Plan

The Retail Plan consists of two primary sections: (1) Declaring a water shortage and (2) Allocation method and process. The former section describes the process for identifying and declaring a water shortage due to drought. The latter section describes the process of allocating water amongst retail customers during a drought, the process of appealing those allocations and enforcement of allocations.

II. Process for Declaring Shortage

A. Timing and Assessment of Water System Conditions

The SFPUC water supply system relies on precipitation and snowmelt stored in its reservoirs from one year to the next. It is this "carry-over" storage that the SFPUC relies on to be able to meet wholesale and retail demand. Because of the importance of "carry-over" storage, the water supply condition of the SFPUC system is constantly monitored and evaluated. Look-ahead forecasts are updated as a year's hydrology and operations change. Generally in early winter of any year, SFPUC staff can begin providing a forecast of water supply conditions for the upcoming year based on known and anticipated winter and spring precipitation and snowpack. The annual precipitation, snowmelt, and "carry-over" storage together constitute the SFPUC's reservoir storage condition. Using data for each of these factors, SFPUC staff is able to determine whether the reservoir system will be capable of serving full deliveries to the SFPUC customers.

Consistent with the Interim Water Shortage Allocation Plan, if the SFPUC reservoir system appears incapable of meeting system-wide demand due to drought, the SFPUC is expected to declare a water shortage by March 31 of that drought year. The General Manager, or designee, is responsible for declaring such a shortage.

B. Delivery Reduction Levels

To aid in balancing the SFPUC supplies with demands during drought, the SFPUC has developed a general protocol that links anticipated total[8] reservoir storage conditions to suggested delivery reductions. The SFPUC total reservoir system has the capacity to store up to 1,627,000 acre-feet. In relation to this storage capacity and a current system-wide demand of 260 million gallons per day (mgd), when it appears the total system storage will not reach above approximately 1,000,000 acre-feet at the end of the spring-summer snowmelt, the SFPUC may begin to evaluate whether the reservoir system will be capable of serving full deliveries to its customers.[9] If the reservoir system is determined incapable of serving full deliveries to SFPUC customers, the SFPUC may impose a level of delivery reduction. As anticipated reservoir storage becomes more depleted during drought, a greater level of delivery reduction may be required. There are three stages of water delivery reduction that correspond to the SFPUC protocol. The three stages are:

(1) Stage 1 – requires system-wide demand reduction of 5 to 10 percent. This stage results in a voluntary rationing request of customers. At this stage, it is likely that retail water customers will be alerted to the status of water supply conditions and reminded of water use prohibitions as well as informed of any incentives and programs available to reduce water demand (i.e. acceleration of long-term conservation programs such as toilet rebate programs, leak detection audits, and the like)

---

[8] "total reservoir storage" includes all system reservoirs (Lloyd, Eleanor, Hetch Hetchy, San Anotonio, Calaveras, Crystal Springs, Pilarcitos, and San Andreas) and the water bank at New Don Pedro Reservoir.
[9] This reduction point is subject to change as total system-wide demand increases over time.

(2) Stage 2 – requires system-wide demand reduction of 11 to 20 percent. This stage results in mandatory rationing programs. In addition to implementing Stage 1 actions, all customers will receive an allocation of water. Any use beyond that allocation will become subject to excess use charges, installation of flow restrictor devices or shut-off of water. The latter two consequences may also be imposed if water waste prohibitions are violated.

(3) Stage 3 – requires system-wide demand reduction of 20 percent or greater. This stage results in mandatory rationing programs and results in the same actions identified under Stage 2 with further reduced allocations.

C. Initiation of Delivery Reduction Program

Prior to the initiation of any of water delivery reductions, whether it be initial implementation of reduced delivery or increasing the severity of water shortage, the SFPUC will outline the water supply situation, proposed water use reduction objectives, alternatives to water use reductions, methods to calculate water use allocations and adjustments, compliance methodology and enforcement measures, and budget considerations at a regularly scheduled Commission meeting for public input. The meeting will be advertised and the public will be invited to comment on the SFPUC's intent to reduce deliveries in accordance with the requirements of California Water Code Section 6066 of the Government Code.

Revenue and Expenditure Impacts During Water Shortages. The SFPUC uses a uniform volume charge. As a result, as sales decrease revenues are lost on a per unit basis. Because the marginal cost of water production is miniscule, as production is reduced the cost of service remains the same. Therefore, during a water shortage, as occurred during the 1987-92 drought, the SFPUC may need to raise water rates to make up for lost revenue due to less water use. The SFPUC retail rates, however, are frozen until 2006 due to Proposition H. As a result, retail rates cannot be adjusted to make up for revenue shortfalls unless voters repeal the Proposition or the Mayor declares an emergency as provided for in the City's Charter. The SFPUC does maintain an unappropriated fund balance that can be used to offset the effects of revenue shortfall. Budget considerations will be discussed at the time a drought is declared and revisited as the drought progresses.

III. Allocation Method and Process

A. Types of Allocation Methods

In the event of a mandatory rationing program, the SFPUC must adopt a system for allocating water amongst its retail customers. During the 1987-1992 drought four allocation methods were considered. They were the inside/outside or seasonal allocation method, the per capita allocation method, the uniform allocation method, and the percentage allocation method. The following provides of a description of each method and potential advantages or disadvantages of applying each method.

Inside/Outside allocation method. The Inside/Outside method, also referred to as seasonal method, applies a percent reduction to both indoor and outdoor use. To determine an individual's allocation, a base year is used and reductions are made to both inside and outside usage. Winter usage is identified as typically reflecting inside use. The average of the winter months (November, December, January, February) of the base year is used as the baseline for determining inside use for all 12 months. Usage in excess of the baseline is considered outside use. The monthly or bi-monthly inside/outside allocation is a composite of the inside use and the outside use reduced by their respective percentages. This method distributes water equitably and has been proven effective in achieving prior system-wide consumption goals. However, because this method reduces water allocations for all customers regardless of their current use, there is concern that water users consuming very low amounts of water will be affected disproportionately.

Per capita allocation method. The per capita allocation method applies a fixed amount of daily water for each resident. The allocation method requires that each residential occupant receives a fixed daily amount of water. To implement this method a census of the service area is required. Conducting a census is highly time consuming and the response to the survey is often statistically low and inaccurate. The method does not allow for differences in dwelling type, existing landscaping needs or special individual circumstances. A per capita allocation would prove unworkable with commercial and industrial customers and would require a different method for determining allocations.

Uniform allocation method. The uniform allocation method applies a fixed daily amount per dwelling unit for all residential customers. This method does not distribute water equitably to all customers, especially since it does not take into considerations the number of individuals living in the dwelling unit. As in the per capita plan, this method would prove unworkable for commercial and industrial customers.

Percentage allocation method. The method requires water allocation to be based on a straight percent reduction of past use. As an example to achieve a specified reduction goal, all customers would be allotted a percentage of the amount used in each billing period in the base year. The method requires a much greater reduction in inside use and could cause hardship on residential and commercial customers.

B. Preferred Allocation Method: Inside/Outside Method

During the 1987-92 drought the Inside/Outside method was implemented because it was found to be the most fair and reasonable method amongst the alternatives. At that time for those customers that appealed their allocations a per capita allocation was applied to the account.[10]

The Inside/Outside method will be applied to allocating water amongst retail customers during a water shortage due to drought. The allocation method will be applied to all accounts using more than 3 units of water per two-month billing period. A percentage reduction of inside and outside use will be applied to all accounts using more than 3 units of water during a two-month billing period. The appropriate percentage reductions to inside and outside use will be determined by the General Manager, or designee. The per capita allocation method will be used for customers who appeal their allotments. The formula will be similar in structure to that used during the 1987-92 drought. The General Manager, or designee, will determine at the time of the drought the number of gallons per capita per day to be used for the per capita method.

C. Allocation Process

As discussed previously, if the SFPUC anticipates that the reservoir system will be incapable of serving full deliveries to its customers, the SFPUC will announce a drought by March 31st. Consistent with the Interim Water Shortage Allocation Plan, the SFPUC will inform its retail customers of a water shortage by March 31st. The SFPUC will determine water allocations for each retail customer account using the Inside/Outside allocation method. Average winter and summer use factored into the Inside/Outside methodology will be based on water use for each retail customer from the previous year. For drought periods covering consecutive years, allocations will be based on water use for the last year prior to the drought declaration. The SFPUC will provide water use allocations to all retail customers by May 1st of the drought year. The water use allocations will become effective July 1st.

D. Appeal Process

On or before May 1st, retail customers will be notified of their reduced water allocations. Each retail customer will have the opportunity to appeal the allocation based on increased occupancy, medical exemptions, increased business, or other miscellaneous reasons. The SFPUC will provide retail customers with instructions on how to file appeals at the time the customers are notified of the water use allocations. The SFPUC will also inform customers of the methodology to be used in modifying allocations if they are granted.

---

[10] For illustration purposes the following describes how the per capita method was applied to appeals. The per capita allocation was calculated based on the number of occupants and a formula of 63 gpcpd for the first occupant, 55 gpcpd for the second occupant and 50 gpcpd for each additional occupant with a maximum total of 498 gpd per dwelling unit. As the 1987-92 drought worsened, the per capita allocation was based on the number of occupants and a formula of 50 gpcpd and a maximum total of 300 gpd for single family residences. It is important to note that at the time of the drought the average residential use was 74 gpcpd. Current average demand is 61 gpcpd.

E. Enforcement

The primary methods of enforcing mandatory rationing include excess use charges; installation of flow restrictors and/or shut-off of water.

During the 1987-92 drought excess use charges were applied as follows:

- If a customer consumed up to 10% over their allotment they would be charged 2 times the normal rate;
- If a customer consumed 10.01% to 20% over their allotment they would be charged 8 times the normal rate; and
- If a customer consumed 20.01% or over their allotment they would be charges 10 times the normal rate.

In the event of mandatory rationing, the SFPUC will impose excess use charges similar to those described above. The General Manager, or designee, will inform retail customers of the multiplier rate that will be applied for determining excess use charges. The SFPUC will also offer an audit at the first run-over of the allocation to determine if there are any leaks. In some cases, excess use charges may be reversed if leaks are found and repaired immediately.

In the event that water is used in excess of the customer's specified allotment, the SFPUC could, after one written warning, install a flow restrictor on the customer's service line. The customer may be charged to install and remove the flow restrictor, as was done in the 1987-92 drought. The General Manager, or designee, will determine the relevant charge at the time of the drought. If a customer continues to consume water in excess of its allotment, the SFPUC has the authority to discontinue the customer's water service and require the customer to bear the cost for the re-connection of water service.

The Landlord Pass-through Ordinance[11] allows landlords to pass up to 50 percent of excess use charges on to their tenants under the following conditions:

(a) the landlord must provide written certification that permanently-installed retrofit devices to reduce water use in toilet flushing or low-flow toilets (1.6 gallons per flush), low flow showerheads (no more than 2.5 gallons per minute), and faucet aerators (where installation is physically feasible);
(b) the landlord provides written certification that there are no none plumbing leaks in the building and that any reported leaks have been fixed; and
(c) the landlord provides a copy of the water bill for the period in which the penalty was charged.

Under mandatory rationing, the SFPUC will also specify waste water prohibitions that if violated may result in installation of a flow restrictor and shut-off of water, if the violation continues.

[11] San Francisco Administrative Code Section 37.3

All or some of the following water waste prohibitions may be enforced during a drought. The General Manager, or designee, will declare and inform customers of all water waste prohibitions at the time of a drought.

Water Waste Prohibitions

- Water waste, including but not limited to, any flooding or runoff into the street or gutters, shall be prohibited.

- Hoses shall not be used to clean sidewalks, driveways, patios, plazas, homes, businesses, parking lots, roofs, awnings or other hard surfaces areas.

- Hoses used for any purpose shall have positive shutoff valves.

- Restaurants shall serve water to customers only upon request.

- Potable water shall not to be used to clean, fill or maintain levels in decorative fountains.

- Use of additional water shall not be allowed for new landscaping or expansion of existing facilities unless low water use landscaping designs and irrigation systems are employed.

- Water service connections for new construction shall be granted only if water saving fixtures or devices are incorporated into the plumbing system.

- Use of potable water for consolidation of backfill, dust control or other non-essential construction purposes shall be prohibited.

- Irrigation of lawns, play fields, parks, golf courses, cemeteries, and landscaping of any type with potable water shall be reduced by at least the amount specified for outside use in the adopted rationing plan.

- Verified water waste as determined by the Water Department would serve as prima facie evidence that the allocation assigned to the water account is excessive; therefore, the allocation shall be subject to review and possible reduction, including termination of service.

- Water used for all cooling purposes shall be recycled.

- The use of groundwater and/or reclaimed water for irrigation of golf courses, median strips, and similar turf areas shall be strongly encouraged.

- The use of groundwater and/or reclaimed water for street sweepers/washers shall be strongly encouraged.

- The washing of all automobiles, motorcycles, RVS, trucks, transit vehicles, trailers, boats, trains and airplanes shall be prohibited outside of a commercial washing facility.

- Exceptions to the above use restriction will apply to windows on all vehicles and such commercial or safety vehicles requiring cleaning for health and safety reasons.

- Water used for all cooling purposes or for commercial car washes shall be recycled.

- The use of potable water on golf courses shall be limited to the irrigation of putting greens. The use of groundwater and reclaimed water shall be permitted when approved by the Department of Health.

- The filling of new swimming pools, spas, hot tubs or the draining and refilling of existing pools, etc., shall be prohibited; topping off shall be allowed to the extent that the designated allocation is not exceeded.

- The irrigation of median strips with potable water shall be prohibited. The use of groundwater and reclaimed water shall be permitted when approved by the Department of Health.

- The use of potable water for street sweepers/washers shall be prohibited. The use of groundwater and reclaimed water shall be permitted when approved by the Department of Health.

APPENDIX M

Sample Water Shortage Contingency Resolution

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. **00-0244**

WHEREAS, The Public Utilities Commission in collaboration with the Bay Area Water Users Association, representing the Suburban Purchasers collectively, developed an Interim Water Shortage Allocation Plan (the Plan) pursuant to Section 7.03(a) of the 1984 Settlement Agreement and Master Water Sales Contract; and

WHEREAS, This Plan identifies a water allocation method to be used to determine the fair and reasonable share of water between the SFPUC and its Suburban Purchasers during times when the SFPUC determines a system-wide water shortage caused by drought; and

WHEREAS, The allocation method described in this Plan will be effective for system-wide shortages up to 20 percent during droughts; and

WHEREAS, This Plan provides for water transfers, banking and excess use charges; now, therefore, be it

RESOLVED, That this Commission adopts the Interim Water Shortage Allocation Plan, as attached; and, be it

FURTHER RESOLVED, That the Interim Water Shortage Allocation Plan does not take effect unless adopted by all 29 Suburban Purchasers.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of October 24, 2000

Gill R. Thompson

Secretary, Public Utilities Commission

PUBLIC UTILITIES COMMISSION

City and County of San Francisco

RESOLUTION NO. **01-0245**

WHEREAS, The SFPUC has prepared a Retail Water Shortage Allocation Plan that identifies a process and procedure for allocating water amongst its retail customers during a drought; and

WHEREAS, This Plan identifies a water allocation method to be used to determine the fair and reasonable share of water amongst its retail customers during times when the SFPUC determines a system-wide water shortage caused by drought; and

WHEREAS, The allocation method described in this Plan will be effective for system-wide shortages due to droughts; now, therefore, be it

RESOLVED, That this Commission adopts the Retail Water Shortage Allocation Plan.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of December 11, 2001

Secretary, Public Utilities Commission

APPENDIX N

Water Shortage Allocation Plan with Wholesale Customers

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

WATER SHORTAGE ALLOCATION PLAN

This Interim Water Shortage Allocation Plan ("Plan") describes the method for allocating water between the San Francisco Public Utilities Commission ("SFPUC") and the Wholesale Customers collectively during shortages caused by drought. The Plan implements a method for allocating water among the individual Wholesale Customers which has been adopted by the Wholesale Customers. The Plan includes provisions for transfers, banking, and excess use charges. The Plan applies only when the SFPUC determines that a system-wide water shortage due to drought exists, and all references to "shortages" and "water shortages" are to be so understood. This Plan was adopted pursuant to Section 7.03(a) of the 1984 Settlement Agreement and Master Water Sales Contract and has been updated to correspond to the terminology used in the June 2009 Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County and Santa Clara County ("Agreement").

SECTION 1. SHORTAGE CONDITIONS

1.1. Projected Available SFPUC Water Supply. The SFPUC shall make an annual determination as to whether or not a shortage condition exists. The determination of projected available water supply shall consider, among other things, stored water, projected runoff, water acquired by the SFPUC from non-SFPUC sources, inactive storage, reservoir losses, allowance for carryover storage, and water bank balances, if any, described in Section 3.

1.2 Projected SFPUC Purchases. The SFPUC will utilize purchase data, including volumes of water purchased by the Wholesale Customers and by Retail Customers (as those terms are used in the Agreement) in the year immediately prior to the drought, along with other available relevant information, as a basis for determining projected system-wide water purchases from the SFPUC for the upcoming year.

1.3. Shortage Conditions. The SFPUC will compare the available water supply (Section 1.1) with projected system-wide water purchases (Section 1.2). A shortage condition exists if the SFPUC determines that the projected available water supply is less than projected system-wide water purchases in the upcoming Supply Year (defined as the period from July 1 through June 30). When a shortage condition exists, SFPUC will determine whether voluntary or mandatory actions will be required to reduce purchases of SFPUC water to required levels.

1.3.1 Voluntary Response. If the SFPUC determines that voluntary actions will be sufficient to accomplish the necessary reduction in water use throughout its service area, the SFPUC and the Wholesale Customers will make good faith efforts to reduce their water purchases to stay within their annual shortage allocations and associated monthly water use budgets. The SFPUC will not impose excess use charges during periods of voluntary rationing, but may suspend the prospective accumulation of water bank credits, or impose a ceiling on further accumulation of bank credits, consistent with Section 3.2.1 of this Plan.

1.3.2 Mandatory Response. If the SFPUC determines that mandatory actions will be required to accomplish the necessary reduction in water use in the SFPUC service area, the SFPUC may implement excess use charges as set forth in Section 4 of this Plan.

1.4. Period of Shortage. A shortage period commences when the SFPUC determines that a water shortage exists, as set forth in a declaration of water shortage emergency issued by the SFPUC pursuant to California Water Code Sections 350 et seq. Termination of the water shortage emergency will be declared by resolution of the SFPUC.

SECTION 2. SHORTAGE ALLOCATIONS

2.1. Annual Allocations between the SFPUC and the Wholesale Customers. The annual water supply available during shortages will be allocated between the SFPUC and the collective Wholesale Customers as follows:

Level of System Wide Reduction in Water Use Required	Share of Available Water	
	SFPUC Share	Wholesale Customers Share
5% or less	35.5%	64.5%
6% through 10%	36.0%	64.0%
11% through 15%	37.0%	63.0%
16% through 20%	37.5%	62.5%

The water allocated to the SFPUC shall correspond to the total allocation for all Retail Customers.

2.2 Annual Allocations among the Wholesale Customers. The annual water supply allocated to the Wholesale Customers collectively during system wide shortages of 20 percent or less will be apportioned among them based on a methodology adopted by all of the Wholesale Customers, as described in Section 3.11(C) of the Agreement. In any year for which the methodology must be applied, the Bay Area Water Supply and Conservation Agency ("BAWSCA") will calculate each Wholesale Customer's individual percentage share of the amount of water allocated to the Wholesale Customers collectively pursuant to Section 2.1. Following the declaration or reconfirmation of a water shortage emergency by the SFPUC, BAWSCA will deliver to the SFPUC General Manager a list, signed by the President of BAWSCA's Board of Directors and its General Manager, showing each Wholesale Customer together with its percentage share and stating that the list has been prepared in accordance with the methodology adopted by the Wholesale Customers. The SFPUC shall allocate water to each Wholesale Customer, as specified in the list. The shortage allocations so established may be transferred as provided in Section 2.5 of this Plan. If BAWSCA or all Wholesale Customers do not provide the SFPUC with individual allocations, the SFPUC may make a final allocation decision after first meeting and discussing allocations with BAWSCA and the Wholesale Customers.

The methodology adopted by the Wholesale Customers utilizes the rolling average of each individual Wholesale Customer's purchases from the SFPUC during the three immediately

preceding Supply Years. The SFPUC agrees to provide BAWSCA by November 1 of each year a list showing the amount of water purchased by each Wholesale Customer during the immediately preceding Supply Year. The list will be prepared using Customer Service Bureau report MGT440 (or comparable official record in use at the time), adjusted as required for any reporting errors or omissions, and will be transmitted by the SFPUC General Manager or his designee.

2.3. Limited Applicability of Plan to System Wide Shortages Greater Than Twenty Percent. The allocations of water between the SFPUC and the Wholesale Customers collectively, provided for in Section 2.1, apply only to shortages of 20 percent or less. The SFPUC and Wholesale Customers recognize the possibility of a drought occurring which could create system-wide shortages greater than 20 percent despite actions taken by the SFPUC aimed at reducing the probability and severity of water shortages in the SFPUC service area. If the SFPUC determines that a system wide water shortage greater than 20 percent exists, the SFPUC and the Wholesale Customers agree to meet within 10 days and discuss whether a change is required to the allocation set forth in Section 2.1 in order to mitigate undue hardships that might otherwise be experienced by individual Wholesale Customers or Retail Customers. Following these discussions, the Tier 1 water allocations set forth in Section 2.1 of this Plan, or a modified version thereof, may be adopted by mutual written consent of the SFPUC and the Wholesale Customers. If the SFPUC and Wholesale Customers meet and cannot agree on an appropriate Tier 1 allocation within 30 days of the SFPUC's determination of water shortage greater than 20 percent, then (1) the provisions of Section 3.11(C) of the Agreement will apply, unless (2) all of the Wholesale Customers direct in writing that a Tier 2 allocation methodology agreed to by them be used to apportion the water to be made available to the Wholesale Customers collectively, in lieu of the provisions of Section 3.11(C).

The provisions of this Plan relating to transfers (in Section 2.5), banking (in Section 3), and excess use charges (in Section 4) shall continue to apply during system-wide shortages greater than 20 percent.

2.4. Monthly Water Budgets. Within 10 days after adopting a declaration of water shortage emergency, the SFPUC will determine the amount of Tier 1 water allocated to the Wholesale Customers collectively pursuant to Section 2.1. The SFPUC General Manager, using the Tier 2 allocation percentages shown on the list delivered by BAWSCA pursuant to Section 2.2, will calculate each Wholesale Customer's individual annual allocation. The SFPUC General Manager, or his designee, will then provide each Wholesale Customer with a proposed schedule of monthly water budgets based on the pattern of monthly water purchases during the Supply Year immediately preceding the declaration of shortage (the "Default Schedule"). Each Wholesale Customer may, within two weeks of receiving its Default Schedule, provide the SFPUC with an alternative monthly water budget that reschedules its annual Tier 2 shortage allocation over the course of the succeeding Supply Year. If a Wholesale Customer does not deliver an alternative monthly water budget to the SFPUC within two weeks of its receipt of the Default Schedule, then its monthly budget for the ensuing Supply Year shall be the Default Schedule proposed by the SFPUC.

Monthly Wholesale Customer water budgets will be derived from annual Tier 2 allocations for purposes of accounting for excess use. Monthly Wholesale Customer water budgets shall be adjusted during the year to account for transfers of shortage allocation under Section 2.5 and

transfers of banked water under Section 3.4.

2.5. Transfers of Shortage Allocations. Voluntary transfers of shortage allocations between the SFPUC and any Wholesale Customers, and between any Wholesale Customers, will be permitted using the same procedure as that for transfers of banked water set forth in Section 3.4. The SFPUC and BAWSCA shall be notified of each transfer. Transfers of shortage allocations shall be deemed to be an emergency transfer and shall become effective on the third business day after notice of the transfer has been delivered to the SFPUC. Transfers of shortage allocations shall be in compliance with Section 3.05 of the Agreement. The transferring parties will meet with the SFPUC, if requested, to discuss any effect the transfer may have on its operations.

SECTION 3. SHORTAGE WATER BANKING

3.1. Water Bank Accounts. The SFPUC shall create a water bank account for itself and each Wholesale Customer during shortages in conjunction with its resale customer billing process. Bank accounts will account for amounts of water that are either saved or used in excess of the shortage allocation for each agency; the accounts are not used for tracking billings and payments. When a shortage period is in effect (as defined in Section 1.4), the following provisions for bank credits, debits, and transfers shall be in force. A statement of bank balance for each Wholesale Customer will be included with the SFPUC's monthly water bills.

3.2. Bank Account Credits. Each month, monthly purchases will be compared to the monthly budget for that month. Any unused shortage allocation by an agency will be credited to that agency's water bank account. Credits will accumulate during the entire shortage period, subject to potential restrictions imposed pursuant to Section 3.2.1. Credits remaining at the end of the shortage period will be zeroed out; no financial or other credit shall be granted for banked water.

3.2.1. Maximum Balances. The SFPUC may suspend the prospective accumulation of credits in all accounts. Alternatively, the SFPUC may impose a ceiling on further accumulation of credits in water bank balances based on a uniform ratio of the bank balance to the annual water allocation. In making a decision to suspend the prospective accumulation of water bank credits, the SFPUC shall consider the available water supply as set forth in Section 1.1 of this Plan and other reasonable, relevant factors.

3.3. Account Debits. Each month, monthly purchases will be compared to the budget for that month. Purchases in excess of monthly budgets will be debited against an agency's water bank account. Bank debits remaining at the end of the fiscal year will be subject to excess use charges (see Section 4).

3.4. Transfers of Banked Water. In addition to the transfers of shortage allocations provided for in Section 2.5, voluntary transfers of banked water will also be permitted between the SFPUC and any Wholesale Customer, and among the Wholesale Customers. The volume of transferred water will be credited to the transferee's water bank account and debited against the transferor's water bank account. The transferring parties must notify the SFPUC and BAWSCA of each transfer in writing (so that adjustments can be made to bank accounts), and will meet with the SFPUC, if requested, to discuss any affect the transfer may have on SFPUC operations. Transfers of banked water shall be deemed to be an emergency transfer and shall become effective on the third business day after notice of the transfer has been delivered to the SFPUC.

If the SFPUC incurs extraordinary costs in implementing transfers, it will give written notice to the transferring parties within ten (10) business days after receipt of notice of the transfer. Extraordinary costs means additional costs directly attributable to accommodating transfers and which are not incurred in non-drought years nor simply as a result of the shortage condition itself. Extraordinary costs shall be calculated in accordance with the procedures in the Agreement and shall be subject to the disclosure and auditing requirements in the Agreement. In the case of transfers between Wholesale Customers, such extraordinary costs shall be considered to be expenses chargeable solely to individual Wholesale Customers and shall be borne equally by the parties to the transfer. In the case of transfers between the SFPUC and a Wholesale Customer, the SFPUC's share of any extraordinary transfer costs shall not be added to the Wholesale Revenue Requirement.

3.4.1. Transfer Limitations. The agency transferring banked water will be allowed to transfer no more than the accumulated balance in its bank. Transfers of estimated prospective banked credits and the "overdrafting" of accounts shall not be permitted. The price of transfer water originally derived from the SFPUC system is to be determined by the transferring parties and is not specified herein. Transfers of banked water shall be in compliance with Section 3.05 of the Agreement.

SECTION 4. WHOLESALE EXCESS USE CHARGES

4.1. Amount of Excess Use Charges. Monthly excess use charges shall be determined by the SFPUC at the time of the declared water shortage consistent with the calendar in Section 6 and in accordance with Section 6.03 of the Agreement. The excess use charges will be in the form of multipliers applied to the rate in effect at the time the excess use occurs. The same excess use charge multipliers shall apply to the Wholesale Customers and all Retail Customers. The excess use charge multipliers apply only to the charges for water delivered at the rate in effect at the time the excess use occurred.

4.2 Monitoring Suburban Water Use. During periods of voluntary rationing, water usage greater than a customer's allocation (as determined in Section 2) will be indicated on each SFPUC monthly water bill. During periods of mandatory rationing, monthly and cumulative water usage greater than a Wholesale Customer's shortage allocation and the associated excess use charges will be indicated on each SFPUC monthly water bill.

4.3. Suburban Excess Use Charge Payments. An annual reconciliation will be made of monthly excess use charges according to the calendar in Section 6. Annual excess use charges will be calculated by comparing total annual purchases for each Wholesale Customer with its annual shortage allocation (as adjusted for transfers of shortage allocations and banked water, if any). Excess use charge payments by those Wholesale Customers with net excess use will be paid according to the calendar in Section 6. The SFPUC may dedicate excess use charges paid by Wholesale Customers toward the purchase of water from the State Drought Water Bank or other willing sellers in order to provide additional water to the Wholesale Customers. Excess use charges paid by the Wholesale Customers constitute Wholesale Customer revenue and shall be included within the SFPUC's annual Wholesale Revenue Requirement calculation.

SECTION 5. GENERAL PROVISIONS GOVERNING WATER SHORTAGE ALLOCATION PLAN

5.1. Construction of Terms. This Plan is for the sole benefit of the parties and shall not be construed as granting rights to any person other than the parties or imposing obligations on a party to any person other than another party.

5.2. Governing Law. This Plan is made under and shall be governed by the laws of the State of California.

5.3. Effect on Agreement. This Plan describes the method for allocating water between the SFPUC and the collective Wholesale Customers during system-wide water shortages of 20 percent or less. This Plan also provides for the SFPUC to allocate water among the Wholesale Customers in accordance with directions provided by the Wholesale Customers through BAWSCA under Section 2.2, and to implement a program by which such allocations may be voluntarily transferred among the Wholesale Customers. The provisions of this Plan are intended to implement Section 3.11(C) of the Agreement and do not affect, change or modify any other section, term or condition of the Agreement.

5.4. Inapplicability of Plan to Allocation of SFPUC System Water During Non-Shortage Periods. The SFPUC's agreement in this Plan to a respective share of SFPUC system water during years of shortage shall not be construed to provide a basis for the allocation of water between the SFPUC and the Wholesale Customers when no water shortage emergency exists.

5.5. Termination. This Plan shall expire at the end of the Term of the Agreement.. The SFPUC and the Wholesale Customers can mutually agree to revise or terminate this Plan prior to that date due to changes in the water delivery capability of the SFPUC system, the acquisition of new water supplies, and other factors affecting the availability of water from the SFPUC system during times of shortage.

SECTION 6. ALLOCATION CALENDAR

6.1. Annual Schedule. The annual schedule for the shortage allocation process is shown below. This schedule may be changed by the SFPUC to facilitate implementation.

6.1.1

In All Years	Target Dates
1. SFPUC delivers list of annual purchases by each Wholesale Customer during the immediately preceding Supply Year	November 1
2. SFPUC meets with the Wholesale Customers and presents water supply forecast for the following Supply Year	February
3. SFPUC issues initial estimate of available water supply	February 1
4. SFPUC announces potential first year of drought (if applicable)	February 1
5. SFPUC and Wholesale Customers meet upon request to exchange information concerning water availability and projected system-wide purchases	February 1-May 31
6. SFPUC issues revised estimate of available water supply, and confirms continued potential shortage conditions, if applicable	March 1
7. SFPUC issues final estimate of available water supply	April 15th or sooner if adequate snow course measurement data is available to form a robust estimate on available water supply for the coming year.
8. SFPUC determines amount of water available to Wholesale Customers collectively	April 15th or sooner if adequate snow course measurement data is available to form a robust estimate on available water supply for the coming year.

In Drought Years	Target Dates
9. SFPUC formally declares the existence of water shortage emergency (or end of water shortage emergency, if applicable) under Water Code Sections 350 et. seq.	April 15-31
10. SFPUC declares the need for a voluntary or mandatory response	April 15-31
11. BAWSCA submits calculation to SFPUC of individual Wholesale Customers' percentage shares of water allocated to Wholesale Customers collectively	April 15- 31
12. SFPUC determines individual shortage allocations, based on BAWSCA's submittal of individual agency percentage shares to SFPUC, and monthly water budgets (Default Schedule)	April 25—May 10
13. Wholesale Customers submit alternative monthly water budgets (optional)	May 8-May 24
14. Final drought shortage allocations are issued for the Supply Year beginning July 1 through June 30	June 1
15. Monthly water budgets become effective	July 1
16. Excess use charges indicated on monthly Suburban bills	August 1 (of the beginning year) through June 30 (of the succeeding year)
17. Excess use charges paid by Wholesale Customers for prior year	August of the succeeding year

This page intentionally left blank.

APPENDIX O

California Urban Water Conservation Council Best Management Practice Coverage Reports 2013 and 2014

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

CUWCC BMP Retail Coverage Report 2013

Foundational Best Managemant Practices for Urban Water Efficiency

BMP 1.1 Operation Practices

ON TRACK

198 San Francisco PUC - Retail

1. Conservation Coordinator provided with necessary resources to implement BMPs?

Name: Julie Ortiz

Title: Water Conservation Manager

Email: jnortiz@sfwater.org

2. Water Waste Prevention Documents

WW Document Name	WWP File Name	WW Prevention URL	WW Prevention Ordinance Terms Description
Option A Describe the ordinances or terms of service adopted by your agency to meet the water waste prevention requirements of this BMP.		http://sfwater.org/modules/showdocument.aspx?documentid=1232	Section E, Rule 12 and Section F, Rule 16 of the SFPUC's Rules and Regulations Governing Water Service to Customers covers water waste prevention. Appendix F of the SFPUC's 2010 UWMP includes the SFPUC's Retail Water Shortage Allocation Plan
Option B Describe any water waste prevention ordinances or requirements adopted by your local jurisdiction or regulatory agencies within your service area.			
Option C Describe any documentation of support for legislation or regulations that prohibit water waste.			
Option D Describe your agency efforts to cooperate with other entities in the adoption or enforcement of local requirements consistent with this BMP.			
Option E Describe your agency support positions with respect to adoption of legislation or regulations that are consistent with this BMP.			
Option F Describe your agency efforts to support local ordinances that establish permits requirements for water efficient design in new development.			

At Least As effective As No

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.2 Water Loss Control **ON TRACK**

198 San Francisco PUC - Retail

Completed Standard Water Audit Using AWWA Software? Yes

AWWA File provided to CUWCC? Yes

FY 12-13 AWWA Water Audit Retailv2.xls

AWWA Water Audit Validity Score?

Complete Training in AWWA Audit Method Yes

Complete Training in Component Analysis Process? Yes

Component Analysis? Yes

Repaired all leaks and breaks to the extent cost effective? Yes

Locate and Repar unreported leaks to the extent cost effective? Yes

Maintain a record keeping system for the repair of reported leaks, including time of report, leak location, type of leaking pipe segment or fitting, and leak running time from report to repair. Yes

Provided 7 Types of Water Loss Control Info

Leaks Repairs	Value Real Losses	Value Apparent Losses	Miles Surveyed	Press Reduction	Cost Of Interventions	Water Saved (AF)
1638	0.18	5.45	265	True	1516743	2.73

At Least As effective As No

Exemption No

Comments:

We are reporting using Version 5 of the AWWA Water Audit spreadsheet, which does not automatically populate the Operational Efficiency Indicator table above. See the spreadsheet for each of the indicators.

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.3 Metering With Commodity **ON TRACK**

198 San Francisco PUC - Retail

Numbered Unmetered Accounts	No
Metered Accounts billed by volume of use	Yes
Number of CII Accounts with Mixed Use Meters	19504
Conducted a feasibility study to assess merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters?	Yes
Feasibility Study provided to CUWCC?	Yes

Date: 4/1/2013

Uploaded file name:

Completed a written plan, policy or program to test, repair and replace meters	Yes

At Least As effective As No

Exemption No

Comments:

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.4 Retail Conservation Pricing **On Track**

198 San Francisco PUC - Retail

Implementation (Water Rate Structure)

Customer Class	Water Rate Type	Conserving Rate?	(V) Total Revenue Comodity Charges	(M) Total Revenue Fixed Carges
Single-Family	Increasing Block	Yes	33756371.88	10075859
Multi-Family	Increasing Block	Yes	49832731.02	4968065.51
Commercial	Uniform	Yes	44718597.91	3052144.27
Industrial	Uniform	Yes	464828.51	45970.95
Institutional	Uniform	Yes	5892309.16	526282.43
Dedicated Irrigation	Allocation Based	Yes	4556749.82	397823.65
Fire Lines	Uniform	Yes	272799.15	3453093.38
Other	Uniform	Yes	9503539.71	1349092.06
			148997927.16	**23868331.25**

Calculate: V / (V + M) **86 %**

Implementation Option: Use Annual Revenue As Reported

☐ Use 3 years average instead of most recent year

Canadian Water and Wastewater Association

Upload file:

Agency Provide Sewer Service: Yes

Customer Class	Rate Type	Conserving Rate?
Single-Family	Increasing Block	Yes
Multi-Family	Increasing Block	Yes
Commercial	Uniform	Yes
Institutional	Uniform	Yes

At Least As effective As No

Exemption No

Comments:

The SFPUC exceeds the 70% volumetric revenue compliance requirement. The database incorrectly notes we are not on track.

BMP 2.1 Public Outreach

ON TRACK

198 **San Francisco PUC - Retail** **Retail**

Does your agency perform Public Outreach programs? Yes

The list of wholesale agencies performing public outreach which can be counted to help the agency comply with the BMP

The name of agency, contact name and email address if not CUWCC Group 1 members

Did at least one contact take place during each quater of the reporting year? Yes

Public Outreach Program List	Number
General water conservation information	35
Total	**35**

Did at least one contact take place during each quater of the reporting year? Yes

Number Media Contacts	Number
News releases	2
Newspaper contacts	10
Radio contacts	1
Television contacts	1
Total	**14**

Did at least one website update take place during each quater of the reporting year? Yes

Public Information Program Annual Budget

Annual Budget Category	Annual Budget Amount
Advertising	22039.4
Printing/Postage	11305.29
Sponsorship	2000
Total Amount:	**35344.69**

Public Outreah Additional Programs

Multimedia Advertising/Public Service announcements

Booths at local fairs/events

Low income high-efficiency direct toilet install program direct mail campaign

Retail point of purchase displays for toilet/clothes washer rebate programs

Rainwater harvesting program

Description of all other Public Outreach programs

BMP 2.2 School Education Programs **ON TRACK**

198 San Francisco PUC - Retail **Retail**

Does your agency implement School Education programs? No

The list of wholesale agencies performing public outreach which can be counted to help the agency comply with the BMP

Materials meet state education framework requirements? Yes

The SFPUC offers a state standards-aligned curriculum to SF elementary school teachers. The curriculum was developed by the SFPUC and teaches students about water conservation, recycled water, desalination and the history of SF's water system.

Materials distributed to K-6? Yes

The 'Our Water' curriculum is standards aligned for 4th and 5th grades; however it can be adapted for all grade levels. The educational unit includes lesson plans, fact sheets and classroom activities to engage students in California water issues.

Materials distributed to 7-12 students? Yes (Info Only)

The 'Our Water' curriculum is also distributed to a limited number of 7th-12th grade classrooms, providing a resource for English language learning classes and special education teachers.

Annual budget for school education program: 121770.00

Description of all other water supplier education programs

Conservation, watershed protection and pollution prevention presentations; conservation demonstration garden, water pollution control plant, and watershed land field trips; teacher training for water conservation related education; school events.

Comments:

At Least As effective As No

Exemption No 0

CUWCC BMP Retail Coverage Report 2014

Foundational Best Managemant Practices for Urban Water Efficiency

BMP 1.1 Operation Practices

ON TRACK

198 San Francisco PUC - Retail

1. Conservation Coordinator provided with necessary resources to implement BMPs?

Name: Julie Ortiz

Title: Water Conservation Manager

Email: jnortiz@sfwater.org

2. Water Waste Prevention Documents

WW Document Name	WWP File Name	WW Prevention URL	WW Prevention Ordinance Terms Description
Option A Describe the ordinances or terms of service adopted by your agency to meet the water waste prevention requirements of this BMP.		http://sfwater.org/modules/showdocument.aspx?documentid=1232	Section E, Rule 12 and Section F, Rule 16 of the SFPUC's Rules and Regulations Governing Water Service to Customers covers water waste prevention. Appendix F of the SFPUC's 2010 UWMP includes the SFPUC's Retail Water Shortage Allocation Plan
Option B Describe any water waste prevention ordinances or requirements adopted by your local jurisdiction or regulatory agencies within your service area.			
Option C Describe any documentation of support for legislation or regulations that prohibit water waste.			
Option D Describe your agency efforts to cooperate with other entities in the adoption or enforcement of local requirements consistent with this BMP.			
Option E Describe your agency support positions with respect to adoption of legislation or regulations that are consistent with this BMP.			
Option F Describe your agency efforts to support local ordinances that establish permits requirements for water efficient design in new development.			

At Least As effective As No

CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.2 Water Loss Control **ON TRACK**

198 San Francisco PUC - Retail

Completed Standard Water Audit Using AWWA Software? Yes

AWWA File provided to CUWCC? Yes

Copy_of_FY_13-14_AWWA_Water_Audit_Retail_v2.xls

AWWA Water Audit Validity Score?

Complete Training in AWWA Audit Method Yes

Complete Training in Component Analysis Process? Yes

Component Analysis? Yes

Repaired all leaks and breaks to the extent cost effective? Yes

Locate and Repar unreported leaks to the extent cost effective? Yes

Maintain a record keeping system for the repair of reported leaks, including time of report, leak location, type of leaking pipe segment or fitting, and leak running time from report to repair. Yes

Provided 7 Types of Water Loss Control Info

Leaks Repairs	Value Real Losses	Value Apparent Losses	Miles Surveyed	Press Reduction	Cost Of Interventions	Water Saved (AF)
1686	0.19	5.83	248	True	1387101	1

At Least As effective As No

Exemption No

Comments:

We are reporting using Version 5 of the AWWA Water Audit spreadsheet, which does not automatically populate the Operational Efficiency Indicator table above. See the spreadsheet for each of the indicators.

BMP 1.3 Metering With Commodity

ON TRACK

198 San Francisco PUC - Retail

Numbered Unmetered Accounts	No
Metered Accounts billed by volume of use	Yes
Number of CII Accounts with Mixed Use Meters	19607
Conducted a feasibility study to assess merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters?	Yes
Feasibility Study provided to CUWCC?	Yes

Date: 4/1/2013

Uploaded file name:

Completed a written plan, policy or program to test, repair and replace meters	Yes

At Least As effective As No

Exemption No

Comments:

BMP 1.4 Retail Conservation Pricing

On Track

198 San Francisco PUC - Retail

Implementation (Water Rate Structure)

Implementation Option: Use Annual Revenue As Reported

☐ Use 3 years average instead of most recent year

Canadian Water and Wastewater Association

Upload file:

Agency Provide Sewer Service: Yes

Customer Class	Rate Type	Conserving Rate?
Single-Family	Increasing Block	Yes
Multi-Family	Increasing Block	Yes
Commercial	Uniform	Yes
Other	Uniform	Yes

At Least As effective As No

Exemption No

Comments:

The SFPUC exceeds the 70% volumetric revenue compliance requirement. The database incorrectly notes we are not on track.

BMP 2.1 Public Outreach

ON TRACK

198 **San Francisco PUC - Retail** **Retail**

Does your agency perform Public Outreach programs? Yes

The list of wholesale agencies performing public outreach which can be counted to help the agency comply with the BMP

The name of agency, contact name and email address if not CUWCC Group 1 members

Did at least one contact take place during each quater of the reporting year? Yes

Public Outreach Program List	Number
General water conservation information	39
Flyers and/or brochures (total copies), bill stuffers, messages printed on bill, information packets	4
Total	**43**

Did at least one contact take place during each quater of the reporting year? Yes

Number Media Contacts	Number
News releases	4
Newspaper contacts	30
Radio contacts	5
Television contacts	20
Online Advertisings	3
Total	**62**

Did at least one website update take place during each quater of the reporting year? Yes

Public Information Program Annual Budget

Annual Budget Category	Annual Budget Amount
Advertising	215944.22
Printing/Postage	60984.49
Total Amount:	**276928.71**

Public Outreah Additional Programs

Multimedia Advertising/Public Service announcements

Booths at local fairs/events

Low income high-efficiency direct toilet install program direct mail campaign

Retail point of purchase displays for toilet/clothes washer rebate programs

Rainwater harvesting program

Description of all other Public Outreach programs

BMP 2.2 School Education Programs

ON TRACK

198 San Francisco PUC - Retail **Retail**

Does your agency implement School Education programs? Yes

The list of wholesale agencies performing public outreach which can be counted to help the agency comply with the BMP

Materials meet state education framework requirements? Yes

The SFPUC offers a state standards-aligned curriculum to SF elementary school teachers. The curriculum was developed by the SFPUC and teaches students about water conservation, recycled water, desalination and the history of SF's water system.

Materials distributed to K-6? Yes

The 'Our Water' curriculum is standards aligned for 4th and 5th grades; however it can be adapted for all grade levels. The educational unit includes lesson plans, fact sheets and classroom activities to engage students in California water issues.

Materials distributed to 7-12 students? Yes (Info Only)

The 'Our Water' curriculum is also distributed to a limited number of 7th-12th grade classrooms, providing a resource for English language learning classes and special education teachers.

Annual budget for school education program: 118989.00

Description of all other water supplier education programs

Conservation, watershed protection and pollution prevention presentations; conservation demonstration garden, water pollution control plant, and watershed land field trips; teacher training for water conservation related education; school events.

Comments:

At Least As effective As No

Exemption No 0

198 San Francisco PUC - Retail

Baseline GPCD 1997-2006: 107.69

GPCD in 2014: 83.6

GPCD Target for 2018: 88.30

Biennial GPCD Compliance Table

ON TRACK

		Target		Highest Acceptable Bound	
Year	Report	% Base	GPCD	% Base	GPCD
2010	1	96.4%	103.80	100%	107.70
2012	2	92.8%	99.90	96.4%	103.80
2014	3	89.2%	96.10	92.8%	99.90
2016	4	85.6%	92.20	89.2%	96.10
2018	5	82.0%	88.3	82.0%	88.30

This page intentionally left blank.

CUWCC BMP Wholesale Coverage Report 2013

Foundational Best Managemant Practices for Urban Water Efficiency

BMP 1.1 Wholesale Agency Assistance Programs

ON TRACK

6297 **San Francisco PUC - Wholesale**

Name: Julie Ortiz Email: jnortiz@sfwater.org

a) Financial Investments and Building Partnerships

b) Technical Support

c) Retail Agency

d) Water Shortage Allocation

Adoption Date: 6/1/2000

File Name: The Wholesale Water Shortage Allocation Plan was adopted pursuant to Section 7.03(a) of the 1984 Settlement Agreement and Master Water Sales Contract and updated in 2009. http://sfwater.org/modules/showdocument.aspx?documentid=1054

e) Non signatory Reporting of BMP implementation by non-signatory Agencies

f) Encourage CUWCC Membership List Efforts to Recuit Retailers

BAWSCA, who coordinates conservation on behalf of SFPUC wholesalers, is a member of the CUWCC and has raised awareness of the benefits and encouraged CUWCC membership among its members who are wholesalers of the SFPUC

At Least As effective As Yes

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC and coordinates regional water conservation assistance, education and outreach in synch with BMP requirements. See attachment for more detail

Exemption No

Comments:

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC and coordinates regional water conservation assistance, education and outreach in synch with BMP requirements. See attachment uploaded under the ALAEA section above.

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.2 Water Loss Control **ON TRACK**

6297 San Francisco PUC - Wholesale

Completed Standard Water Audit Using AWWA Software?	Yes
AWWA File provided to CUWCC?	Yes
FY 12-13 AWWA Water Audit Wholesale v2.xls	
AWWA Water Audit Validity Score?	
Complete Training in AWWA Audit Method	Yes
Complete Training in Component Analysis Process?	Yes
Component Analysis?	Yes
Repaired all leaks and breaks to the extent cost effective?	Yes
Locate and Repar unreported leaks to the extent cost effective?	Yes
Maintain a record keeping system for the repair of reported leaks, including time of report, leak location, type of leaking pipe segment or fitting, and leak running time from report to repair.	Yes

Provided 7 Types of Water Loss Control Info

Leaks Repairs	Value Real Losses	Value Apparent Losses	Miles Surveyed	Press Reduction	Cost Of Interventions	Water Saved (AF)
2			280	False	64330.38	

At Least As effective As No

Exemption No

Comments:

We used Version 5 of the AWWA Water Audit spreadsheet, so the operational efficiency indicators do not automatically populate the table above. Please see the attachment for the individual indicators.

BMP 1.3 Metering With Commodity

ON TRACK

6297 San Francisco PUC - Wholesale

Numbered Unmetered Accounts	No
Metered Accounts billed by volume of use	Yes
Number of CII Accounts with Mixed Use Meters	
Conducted a feasibility study to assess merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters?	No
Feasibility Study provided to CUWCC?	No
Date:	
Uploaded file name:	
Completed a written plan, policy or program to test, repair and replace meters	Yes

At Least As effective As No

Exemption No

Comments:

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.1 Public Outreach **ON TRACK**

6297 **San Francisco PUC - Wholesale** **Wholesale**

Does your agency perform Public Outreach programs? No

The list of retail agencies your agency assists with public outreach

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC, and BAWSCA manages water conservation public outreach for them.

The name of agency, contact name and email address if not CUWCC Group 1 members

Did at least one contact take place during each quater of the reporting year? Yes

Did at least one contact take place during each quater of the reporting year? No

Did at least one website update take place during each quater of the reporting year? Yes

Public Information Program Annual Budget

Description of all other Public Outreach programs

Comments:

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC and coordinates regional water conservation assistance, education and outreach in synch with BMP requirements. See attachment uploaded under the ALAEA section above.

At Least As effective As Yes

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC and coordinates regional water conservation assistance, education and out

Exemption No 0

CUWCC BMP Coverage Report 2013

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.2 School Education Programs

ON TRACK

6297 San Francisco PUC - Wholesale **Wholesale**

Does your agency implement School Education programs? Yes

The list of retail agencies your agency assists with public outreach

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC, and BAWSCA manages water conservation for them

Materials meet state education framework requirements? Yes

Materials distributed to K-6? Yes

Materials distributed to 7-12 students? No (Info Only)

Annual budget for school education program:

Description of all other water supplier education programs

Comments:

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC and coordinates regional water conservation assistance, education and outreach in synch with BMP requirements. See attachment uploaded under the ALAEA section above.

At Least As effective As Yes

BAWSCA represents the SFPUC's wholesalers and coordinates regional water conservation assistance, education and outreach in synch with BMP requirement

Exemption No 0

This page intentionally left blank.

CUWCC BMP Wholesale Coverage Report 2014

Foundational Best Managemant Practices for Urban Water Efficiency

BMP 1.1 Wholesale Agency Assistance Programs

ON TRACK

6297 **San Francisco PUC - Wholesale**

Name: Julie Ortiz Email: jnortiz@sfwater.org

a) Financial Investments and Building Partnerships

BMP Section	Monetary Amount for Financial Incentives	Monetary Amount for Equivalent Resources
BMP 2.1 Public Outreach		250000

b) Technical Support

c) Retail Agency

d) Water Shortage Allocation

Adoption Date: 6/1/2000

File Name: The Wholesale Water Shortage Allocation Plan was adopted pursuant to Section 7.03(a) of the 1984 Settlement Agreement and Master Water Sales Contract and updated in 2009. http://sfwater.org/modules/showdocument.aspx?documentid=1054

e) Non signatory Reporting of BMP implementation by non-signatory Agencies

f) Encourage CUWCC Membership List Efforts to Recuit Retailers

BAWSCA, who coordinates conservation on behalf of SFPUC wholesalers, is a member of the CUWCC and has raised awareness of the benefits and encouraged CUWCC membership among its members who are wholesalers of the SFPUC

At Least As effective As Yes

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC and coordinates regional water conservation assistance, education and outreach in synch with BMP requirements. See attachment for more detail

Exemption No

Comments:

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC and coordinates regional water conservation assistance, education and outreach in synch with BMP requirements. See attachment uploaded under the ALAEA section above.

CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.2 Water Loss Control **ON TRACK**

6297 San Francisco PUC - Wholesale

Completed Standard Water Audit Using AWWA Software?	Yes
AWWA File provided to CUWCC?	Yes
FY 13-14 AWWA Water Audit Wholesale v2.xls	
AWWA Water Audit Validity Score?	
Complete Training in AWWA Audit Method	Yes
Complete Training in Component Analysis Process?	Yes
Component Analysis?	Yes
Repaired all leaks and breaks to the extent cost effective?	Yes
Locate and Repar unreported leaks to the extent cost effective?	Yes
Maintain a record keeping system for the repair of reported leaks, including time of report, leak location, type of leaking pipe segment or fitting, and leak running time from report to repair.	Yes

Provided 7 Types of Water Loss Control Info

Leaks Repairs	Value Real Losses	Value Apparent Losses	Miles Surveyed	Press Reduction	Cost Of Interventions	Water Saved (AF)
9			280	True	35963.95	

At Least As effective As No

Exemption No

Comments:

We used Version 5 of the AWWA Water Audit spreadsheet, so the operational efficiency indicators do not automatically populate the table above. Please see the attachment for the individual indicators.

CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 1.3 Metering With Commodity

ON TRACK

6297 San Francisco PUC - Wholesale

Numbered Unmetered Accounts	No
Metered Accounts billed by volume of use	Yes
Number of CII Accounts with Mixed Use Meters	
Conducted a feasibility study to assess merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters?	No
Feasibility Study provided to CUWCC?	No
Date:	
Uploaded file name:	
Completed a written plan, policy or program to test, repair and replace meters	Yes

At Least As effective As No

Exemption No

Comments:

BMP 2.1 Public Outreach

ON TRACK

6297 **San Francisco PUC - Wholesale** **Wholesale**

Does your agency perform Public Outreach programs? No

The list of retail agencies your agency assists with public outreach

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC, and BAWSCA manages water conservation public outreach for them.

The name of agency, contact name and email address if not CUWCC Group 1 members

Did at least one contact take place during each quater of the reporting year? Yes

Public Outreach Program List	**Number**
General water conservation information	1000000
Total	**1000000**

Did at least one contact take place during each quater of the reporting year? No

Did at least one website update take place during each quater of the reporting year? Yes

Public Information Program Annual Budget

Description of all other Public Outreach programs

Comments:

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC and coordinates regional water conservation assistance, education and outreach in synch with BMP requirements. See attachment uploaded under the ALAEA section above.

At Least As effective As Yes

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC and coordinates regional water conservation assistance, education and out

Exemption No 0

CUWCC BMP Coverage Report 2014

Foundational Best Management Practices For Urban Water Efficiency

BMP 2.2 School Education Programs

ON TRACK

6297 San Francisco PUC - Wholesale **Wholesale**

Does your agency implement School Education programs? Yes

The list of retail agencies your agency assists with public outreach

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC, and BAWSCA manages water conservation for them

Materials meet state education framework requirements? Yes

Materials distributed to K-6? Yes

Materials distributed to 7-12 students? No (Info Only)

Annual budget for school education program:

Description of all other water supplier education programs

Comments:

BAWSCA represents agencies that purchase water on wholesale basis from SFPUC and coordinates regional water conservation assistance, education and outreach in synch with BMP requirements. See attachment uploaded under the ALAEA section above.

At Least As effective As Yes

BAWSCA represents the SFPUC's wholesalers and coordinates regional water conservation assistance, education and outreach in synch with BMP requirement

Exemption No 0

This page intentionally left blank.

APPENDIX P

Resolution to Adopt the 2015 Urban Water Management Plan

2015 URBAN WATER MANAGEMENT PLAN
for the City and County of San Francisco

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission

This page intentionally left blank.

Copy of signed resolution will be available after

adoption hearing tentatively scheduled for June 14, 2016.

This page intentionally left blank.

2015 URBAN WATER MANAGEMENT PLAN

for the City and County of San Francisco

PUBLIC REVIEW DRAFT

Prepared by: The San Francisco Public Utilities Commission

April 2016

San Francisco
Water Power Sewer
Services of the San Francisco Public Utilities Commission